APPLIED HYDRAULICS

JUNE 1955

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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FRANCHISE CIRCULATION

Motor Timers for Dwell Control . . . . . page 45

For information about
THE MASTER CATALOG OF FLUID POWER PRODUCTS
see page 27

Everything You Want

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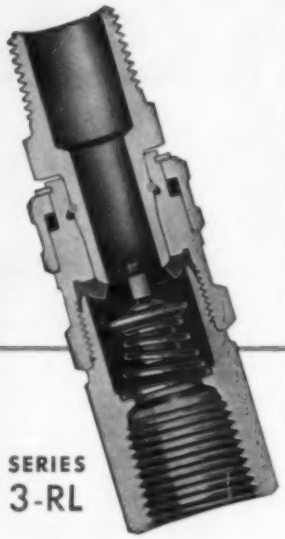

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Compactly designed, the Hansen Series 3-RL Coupling *effectively* handles far more volume than any coupling of equal dimensions. On any job requiring ¾" to ⅛" connections—from the air line to the air tool—this single size Hansen Ring-Lock Coupling—with completely interchangeable Sockets and Plugs—does it all—makes it easy to keep stock of parts in balance—holds inventories to a minimum.

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CHOOSE FROM a broad selection of Hanna Valves to meet your requirements for exacting Air and Hydraulic control. Illustrated are but a few of the complete line of hand, foot, electric and pilot operated valves for directional and speed control. They all carry the Hanna nameplate—an assurance of extraordinary care in design and manufacture—which means years of maintenance-free operation. Your Hanna sales representative offers specialized experience in selecting valve combinations and developing control circuits.

SEND FOR CATALOG

Hanna Valve Catalog No. 254 includes descriptions and specifications on the complete line.

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Hanna Flo-Set Valves have micrometer graduations to assure exacting speed control. Available in ¼", ⅜", ½" and ¾" sizes, they are suitable for air, oil or water control, with maximum pressure to 250 p.s.i. They may be mounted in any position.

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Unitite Valves are suitable as either 3-way or 4-way valves, operating at air, oil or water pressures up to 250 p.s.i. for the ⅜", ½", and ¾" sizes . . . up to 150 p.s.i. for the 1" size . . . and up to 100 p.s.i. for the 1¼" size. Three styles—for standard mounting, column mounting or manifold mounting—are available.

FOOT OPERATED VALVES

Available in ⅜", ½", ¾" and 1" pipe sizes, Hanna Foot Valves are ideal for applications where it is desirable to have the operator's hands free for handling material. Single-pedal and double-pedal models, for pressures up to 250 p.s.i., are available for use with double-acting air and hydraulic cylinders.

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VOLUME 8 NUMBER 6

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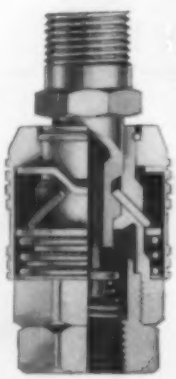

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Fluid Power Lines

about Applied Hydraulics

Timer Circuits

M. G. Saake is the man to talk to about electric timer circuits for air and hydraulic devices. When we stopped by his office in New York, he showed us his circuit notebooks. They represent a wealth of experience and ingenuity.

Using several representative circuits, Mr. Saake has written this month's lead article which tells how and where motor timers can be used. An understanding of the operation of motor timers along with your ingenuity will help to simplify many control circuits.

Electric Buggies

Bob Vance, who authors the article about electric controls on industrial trucks, spent a couple hours enlightening us about battery operated trucks. He is so convincing about their merits, that we wanted to resurrect Grandma's old tiller operated "hot rod".

We asked Bob what the fellow who designs the hydraulics on a battery operated lift truck has to know about electrical controls. He gives us his answer in the article starting on page 53.

Clobber Stopper

In the dictionary we will never write, one of the twenty definitions for the word "clobber" is: *This is what can happen when two automatic machines, one feeding parts to the other, get out of step.* Clobbering opens new vistas for the design engineer. Experts in the prevention of clobbering will design clobber stopper circuits.

All this clever repartee is to introduce you to the article by Carl Meckstroth of General Electric who describes an excellent circuit which assures cylinder movement only when machines are properly synchronized.

Was Tucker Wrong?

Maybe you've forgotten about the never-built Tucker car which was going to really be a super new post-war miracle. Since we were just interested bystanders with no money on-the-line, we don't even recall whether it was Sam or Joe Tucker who was promoting this car. However, we do recall that one of the proposed designs had a fluid motor drive at each wheel. While it doesn't look as though any major passenger car manufacturer will be using such a drive this week, there are signs which indicate that builders of crawler driven construction machines are discovering the hydrostatic transmission as an efficient power source.

One hydraulic crawler tractor drive is described on page 62. This drive offers a number of operating advantages—and what is more important such drives can result in lowering the cost of the machine.

Anyone want a Tucker stock certificate—cheap?

Greater Efficiency for Metering Circuits

Not too many years ago, the use of hydraulics was limited to machines where brute force was needed. Development of flow and pressure controls opened many new applications where accurate feeding with oil power is desired. Much work on feed circuits is being done to reduce the power losses, obtain greater accuracy and ability to handle a large range of varying loads.

In this issue, J. R. Fawcett details a relatively new type of meter-out circuit which greatly reduces power losses. This article is one of a series by Mr. Fawcett. His first, an overall study of speed control methods, appeared in April. This month's article and others which will be published throughout the rest of the year will detail the operation of these very useful circuits.

J. R. Fawcett

Mr. Fawcett has been chief engineer of Budenberg Gauge Co. Ltd., in England since 1937. He worked on the design of machines to produce and measure pressures over 100,000 psi. Hydraulic applications are now one of his major interests.

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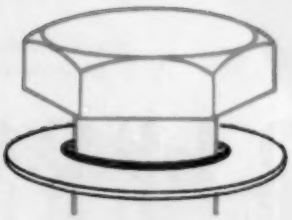
end leakage...have lock washer action with Precision O Dyna-seals



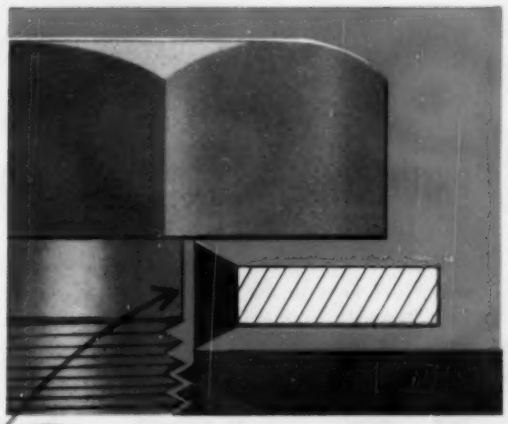
Seal up to 10,000 psi steady or pulsating pressure

Here is today's answer to leakage problems created by face-to-face sealing. Dyna-seals not only completely eliminate leakage but make possible important reductions in tooling, installation and maintenance costs.

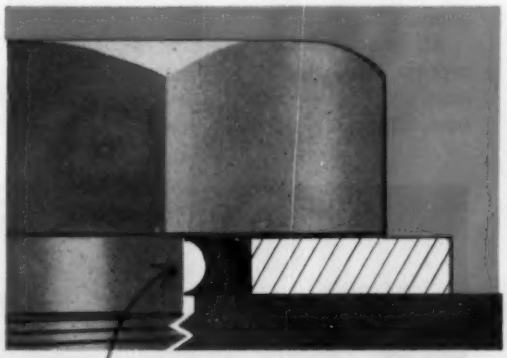
The secret of Dyna-seal success is a synthetic rubber sealing member, heat and pressure bonded to a steel washer. It supplies a positive lock washer action and reduces bolting torque. Under pressure, the flexing action of Dyna-seal assures a positive seal under all conditions—against water, gasses, petroleum products and many other fluids.

Dyna-seals permit face-to-face sealing with no grooves to cut or special machining of surface to be sealed. Here is simplicity in assembly that reduces fabrication costs and improves product appearance as well.

Use Dyna-seals on any flat surface under bolt or rivet heads, cap nuts, flanges, special fittings, etc. Let a Precision engineer work with you and demonstrate the advantages of putting Dyna-seals into your products.



Note flare of rubber sealing member. When compressed under any type of bolt, flange or screw, it provides positive lock washer action, and reduces bolting torque.



When pressure of bolt head is applied, sealing lips are forced against surface, forming a convex shape opposing steady or pulsating pressure. Dyna-seal provides positive sealing against leakage.

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BRIEFS about fluid power

PNEUMATICALLY OPERATED KEY DRIVER SAVES TIME AND LIVES

For driving in or out die and sow block keys in the forge shop, Erie Foundry Company developed and built a key driver, which replaces the hazardous method of driving keys by using a battering ram suspended from an overhead crane.

This key driver, using plant air, can deliver an accurate blow with the controlled force of an 800 pound steam hammer.

All pneumatic components, except the lubricator are of the company's own design and manufacture. The unit is normally handled by a fork-lift truck, and for that reason overall dimensions are kept small for easy maneuvering.

In operation the unit is controlled by a 4-way hand-operated valve. To strike a forward blow, the lever is moved rapidly in one direction. To eliminate the danger of overstroking and possibly damaging the ram end head of the cylinder, the cylinder was designed with a check valve in combination with a metering orifice. This supplies a cushion for the rod end in case the key was not hit by the time it traveled through the length of the stroke. To return the ram for another blow, the valve is moved through the neutral position, which exhausts both ends of the cylinder, to the opposite position which lets the ram come back. The length of each stroke and the force of the blow is controlled by the operator. It is possible to use less than the maximum force for driving a key in, while the maximum blow can be used for driving a key out.

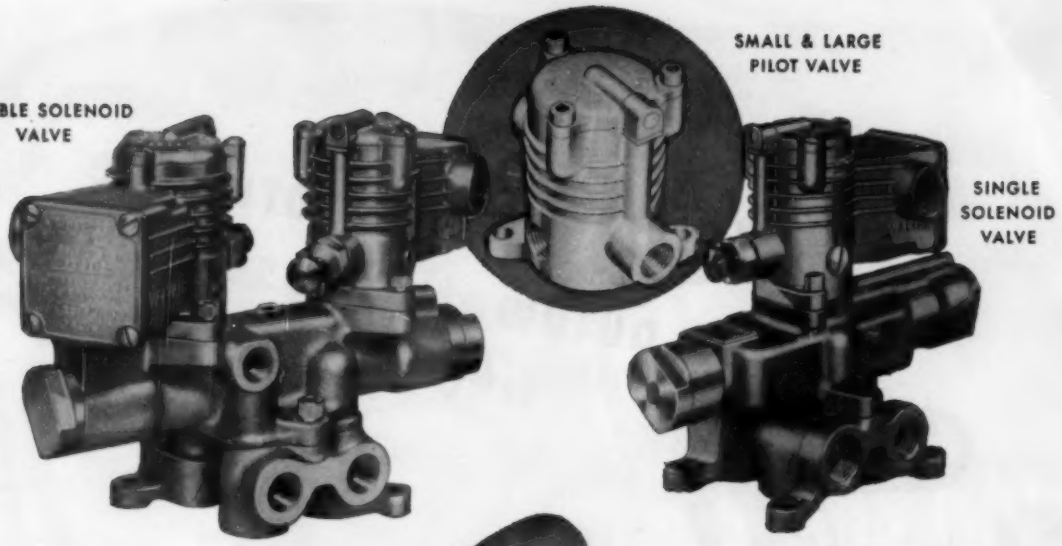
Before this key driver was built the average key driving time was 3½ hours, requiring six men, and negligence on the part of any one man caused serious accidents. Now the operation takes 20 minutes, two men and no extreme physical efforts are required. ▼▼▼

1955 NCIH Adds Computer Session As New Feature

"Application of Electronic Analog Computers to Hydraulic Problems" will be the topic of a general session at the 11th National Conference on Industrial Hydraulics—October 27-28, Hotel La Salle, Chicago.

Papers will be presented by Hugo M. Martinez of the Berkeley Division of Beckman Instruments, Inc., John D. Strong of Electronic

Continued on page 12



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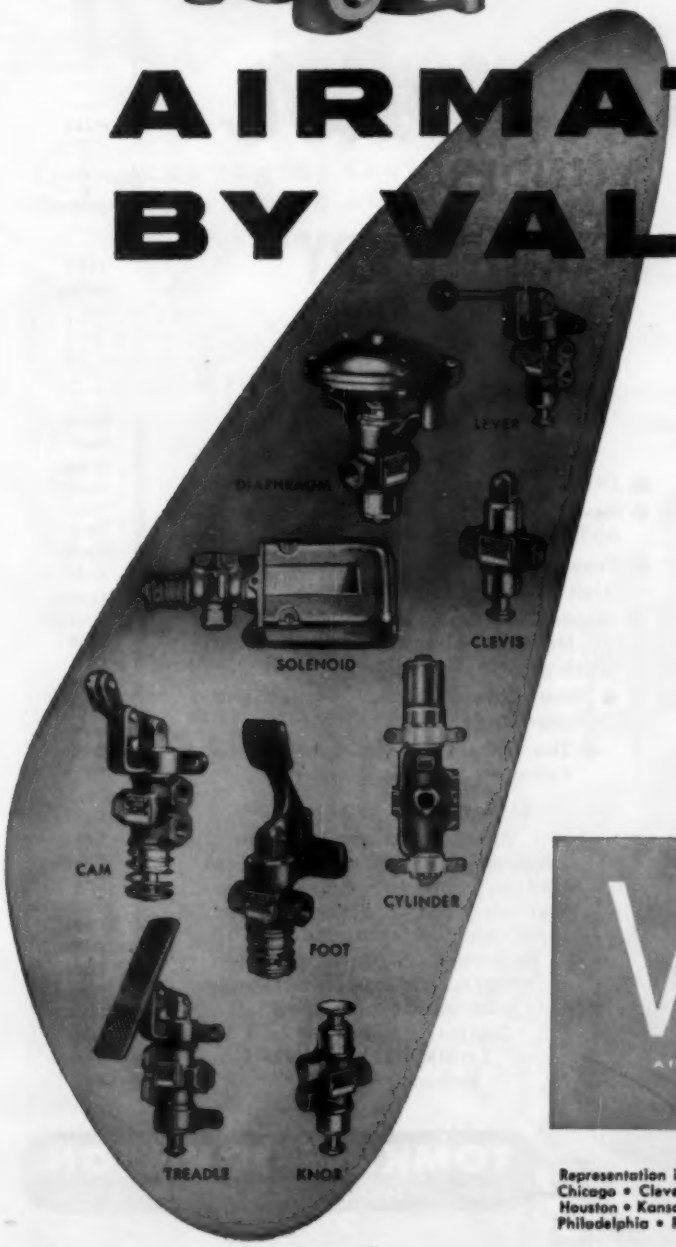

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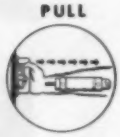

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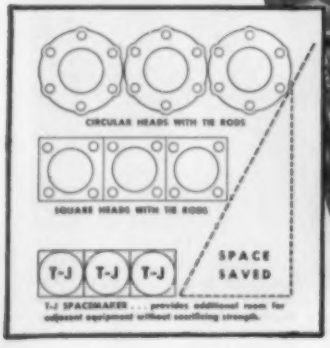
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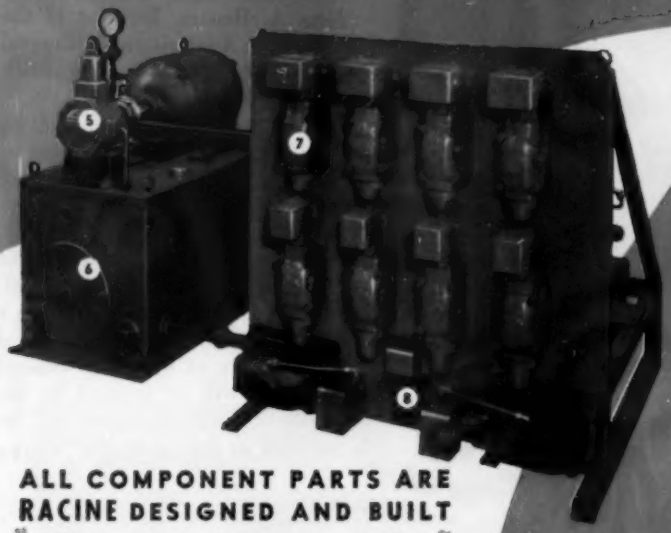

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Zanesville, Ohio

Please send complete information on SECO Series LA Pumps.

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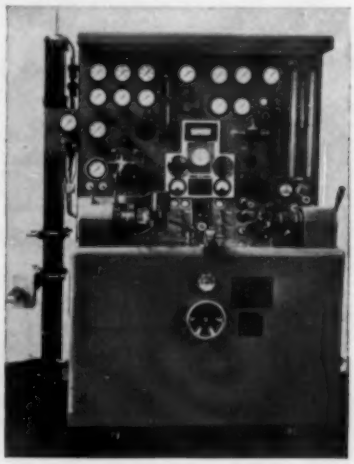
BRIEFS / continued

Associates, Inc., and Professor John A. Hrones, Director of the Dynamic Analysis and Control Laboratory, Massachusetts Institute of Technology.

The theme of the session will be to give a general understanding of how electronic analog computers work and to show how they are used to solve hydraulic problems. An informational presentation of computer theory, ways of simulating hydraulic circuit elements on a computer and demonstrations of the solution of hydraulic control problems will be covered by the speakers. Two computers will be featured at the meeting. ▼▼▼

Test Stand For Pneumatic Equipment

A single universal test stand for all high and low pressure pneumatic and vacuum equipment fitted to military aircraft has been developed by The Hymatic Engineering Company, Ltd., England. The



group of circuits with their associated controls, gauges and measuring instruments enable the unit to simulate in the workshop any operating conditions encountered in flight.

Unit consists of four main sections, each with its own instruments and controls. The first for

Continued on page 14

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Labyrinth flow and lateral leakage are stopped by LINEAR'S uniquely designed, revolutionary VEE-DAM RINGS. Installation of these trouble-saving, long-lasting packings is virtually foolproof!

A STURDY RUBBER DAMS

faced in opposite directions in the grooved hinge area of each ring, hermetically seal off center groove sections when LINEAR VEE-DAM Rings are stacked together . . . eliminating all labyrinth flow.

U. S. Patent No. 2,665,151

B EXTERNAL ABUTMENTS

on the outside shoulder edge of the ring, staggered in relation to the internal dams, prevent lateral leakage, and provide stabilizing support.

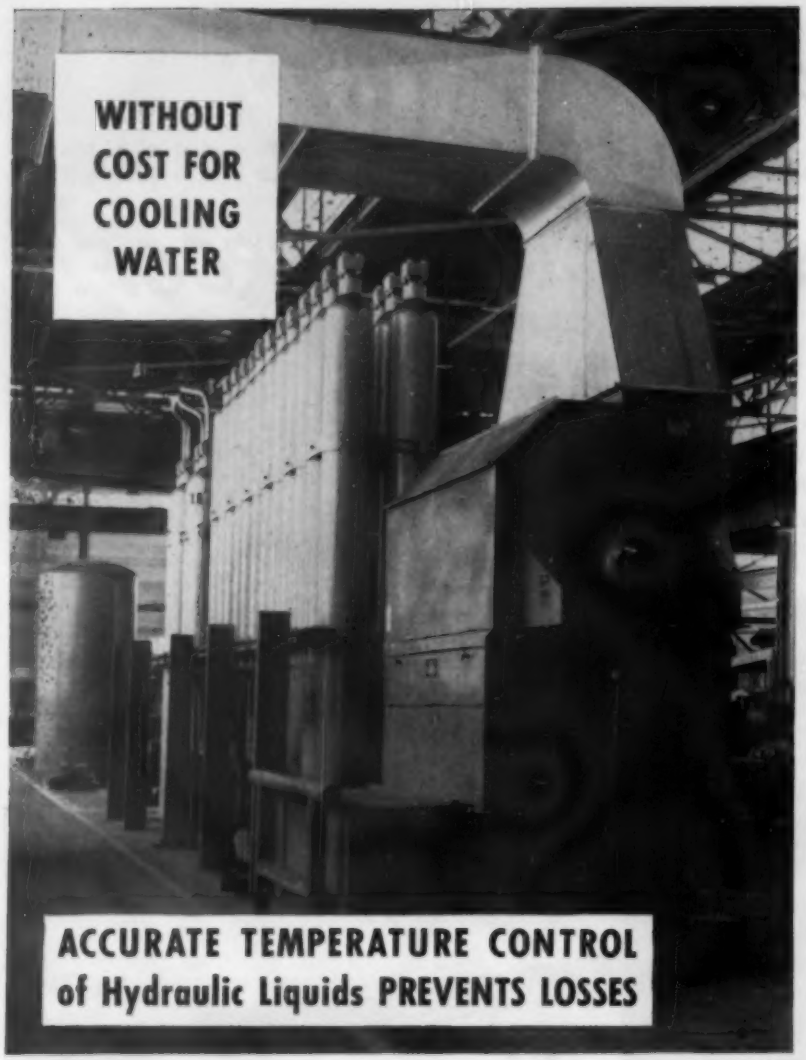
LINEAR VEE-DAM Rings save on installation time because they don't require precise fitting. They provide a perfect seal with minimum gland load, giving lower friction against the ram and far longer life than ordinary packing.

Write or call for complete information on LINEAR VEE-DAM Rings in a choice of rugged, fabric-reinforced synthetic elastomers, tailored to your requirements.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.



● This NIAGARA AERO HEAT EXCHANGER cools the liquid for a large hydraulic press, preventing heat damage to the pump stuffing boxes. Using outdoor air as the evaporative cooling medium, it removes the heat at the rate of input (1,875,000 BTU/hr.) with no cooling water consumption except a negligible amount evaporated.

Air is free and cheaper to move than water. You can save much expense in pumping, piping and power, and quickly recover the equipment cost from the water saving.

Similar Niagara machines cool water, oils, solutions, lubricants and coolants for many mechanical, electrical and chemical processes. You can cool quench baths, welding machines, plastic molds, furnaces, controlled atmospheres, gases, compressed air either for power or instruments or processes. In a closed system, your coolant is never contaminated. The system is simple and easy to keep up; the equipment has a long, useful life. Select from a wide range of sizes up to 30,000,000 BTU.

Write for Bulletin 120 to obtain a complete description.

NIAGARA BLOWER COMPANY

Dept. AH, 405 Lexington Ave. **New York 17, N. Y.**

Niagara District Engineers in Principal Cities of United States and Canada

BRIEFS / continued

testing high pressure pneumatic components, the second for vacuum pumps, low pressure air pumps and components; the third for hydraulically testing pressure vessels and the fourth for testing cylinders.

Of fabricated steel frame construction with detachable steel covers, the unit's instrument panels can be easily removed to simplify maintenance and ensure safety in transit. ▼▼▼

Hydraulic Dump Bucket Scoop Attachment

This detachable dump bucket scoop, easily interchanged with standard forks on any SpaceMaster electric fork trucks, was designed by Lewis-Shepard Products, Inc. A double acting hydraulic cylinder allows controlled dumping. To hold material in the scoop, it tilts up 10 degrees, and to dump it tilts down 40 degrees. Controls are located in the operator's compartment. ▼▼▼

American Standards

A 48 page publication, published and available from the American Standards Association, lists and indexes about 1500 American standards, including those for construction and civil engineering, mechanical, electrical, metallurgy, chemical and many others. A separate section deals with standards for consumer goods. ▼▼▼

Continued on page 18

EXTRA **Mobile Equipment News** EXTRA

VOL.2 VICKERS INCORPORATED, DETROIT, MICHIGAN NO.6

NEW—For Smaller Vehicles

VICKERS HYDRAULIC POWER STEERING

LOW COST

Vickers Series S22 is a new, streamlined steering booster built especially for smaller vehicles. The design permits high production economies . . . and these economies are passed on to vehicle manufacturers.

SUPERIOR PERFORMANCE

The Series S22 has excellent operating characteristics . . . providing smooth, easy, fingertouch steering under all conditions. Obstructions, chuck holes, blown tires, etc. cannot spin the steering wheel or jerk it out of control on vehicles equipped with this Booster. Safer in traffic . . . on the farm . . . in the plant.

SIMPLIFIED DESIGN

Servo valve is simplified and smaller. Ease of servicing is another advantage.

EASY INSTALLATION

Oil connections can be placed in any one of four positions (90° apart) with respect to ball stud. This and the compact design make installation exceptionally easy and reduce its cost.

NEEDS LESS SPACE

Design is unusually compact and streamlined. Series S22 will go into a minimum space and usually requires little or no linkage change.

DEPENDABLE

All the "know-how" acquired in Vickers more than 25 years experience with hydraulic power steering has gone into the design and manufacture of the Series S22. Vickers hydraulic equipment of all kinds has a remarkable record of dependability. This booster is no exception.

ASK FOR NEW BULLETIN

A new bulletin gives more information on the Series S22 together with appropriate Vickers Pumps and typical circuit diagrams. Send for Bulletin M-5107.

For heavier steering applications and longer piston strokes, use Vickers Booster Series S23 (see Bulletin M-5106) or Model S6-315 (see Catalog No. M-5101).

VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1474 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: ATLANTA • CHICAGO AREA (Brookfield) CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER

VICKERS. SERIES VT16 VANE TYPE PUMP

This is the pump normally used with the Series S22 Booster. It has integral volume control and relief valve, and oil reservoir. The vane type design delivers more oil with less power. Automatic wear compensation and hydraulic balance contribute to much longer life with minimum maintenance. No-load starting is another advantage in cold weather.

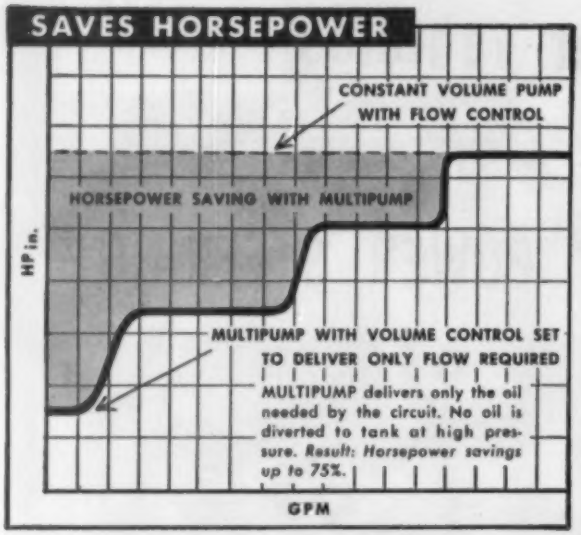
7179

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

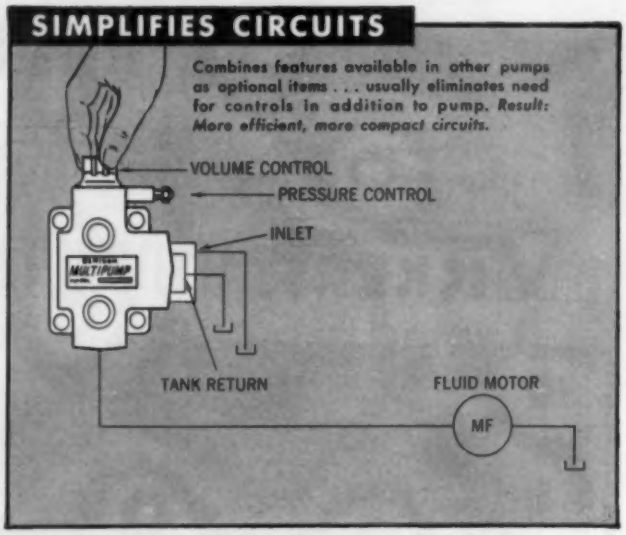
New 1000 psi variable volume vane pump

Denison MULTIPUMP delivers variable volume at constant speed... delivers constant volume at variable speed. *Here's how you can benefit:*

SAVES HORSEPOWER

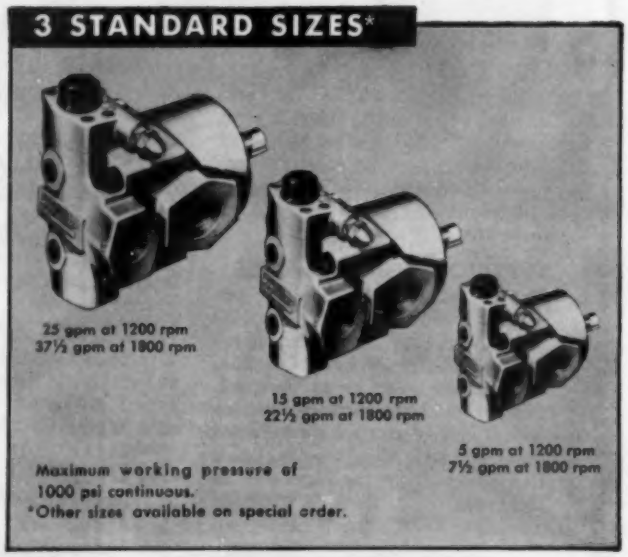

CONSTANT VOLUME PUMP WITH FLOW CONTROL
HORSEPOWER SAVING WITH MULTIPUMP
HP in.
MULTIPUMP WITH VOLUME CONTROL SET TO DELIVER ONLY FLOW REQUIRED
MULTIPUMP delivers only the oil needed by the circuit. No oil is diverted to tank at high pressure. Result: Horsepower savings up to 75%.
GPM

SIMPLIFIES CIRCUITS


Combines features available in other pumps as optional items . . . usually eliminates need for controls in addition to pump. Result: More efficient, more compact circuits.
VOLUME CONTROL
PRESSURE CONTROL
INLET
TANK RETURN
FLUID MOTOR
MF

FINGER-TIP CONTROL

3 STANDARD SIZES*


25 gpm at 1200 rpm
37½ gpm at 1800 rpm
15 gpm at 1200 rpm
22½ gpm at 1800 rpm
5 gpm at 1200 rpm
7½ gpm at 1800 rpm
Maximum working pressure of 1000 psi continuous.
*Other sizes available on special order.

First again! Denison's MULTIPUMP introduces a new, exclusive hydraulic pumping principle of major importance to industry. Learn how it can cut operating costs of your hydraulic systems. Write Denison, ask for Bulletin 190.

THE DENISON ENGINEERING COMPANY
1166 Dublin Road • Columbus 16, Ohio

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS
MOTORS • CONTROLS

Now—here's
real fire prevention
for your plant . . .

New Fire-Resistant

Gargoyle NYVAC Hydraulic Fluids

Do you use hydraulic machines near furnaces, molten metal pots, red-hot steel slabs or other sources of ignition? If so, with oil in service, you have the possibility of a fire that could badly cripple your production.

New fire-resistant Gargoyle Nyvac hydraulic fluids will prevent such fires.

There are two types of these fluids—a straight synthetic fluid and a synthetic water base fluid. Both have been thoroughly proved in the field. Your particular machines and operations will dictate which product is best for your plant.

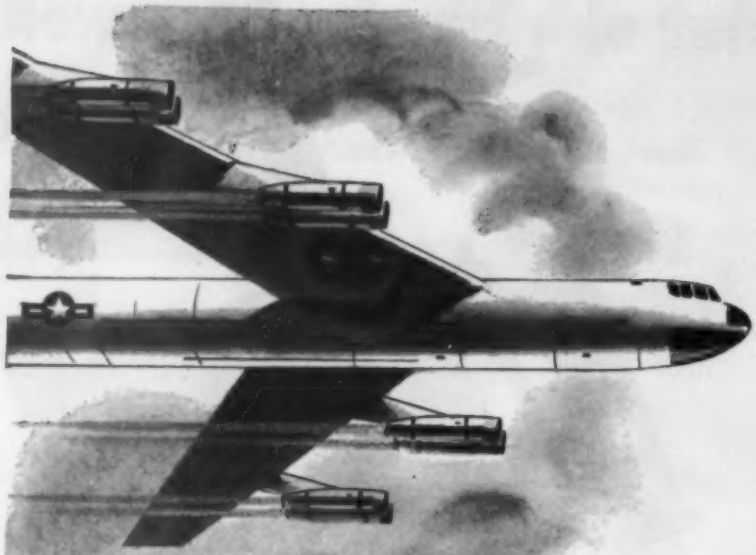
Although synthetic in composition, these new products are still designed to keep your machines running on full production schedules with low maintenance costs. They are backed by Socony Mobil's complete engineering service.

The new Nyvac fluids round out Socony Mobil's complete line of top-quality hydraulic fluids—all available from a single source of supply. Call your Socony Mobil man for complete details.

Socony Mobil *Correct Lubrication*

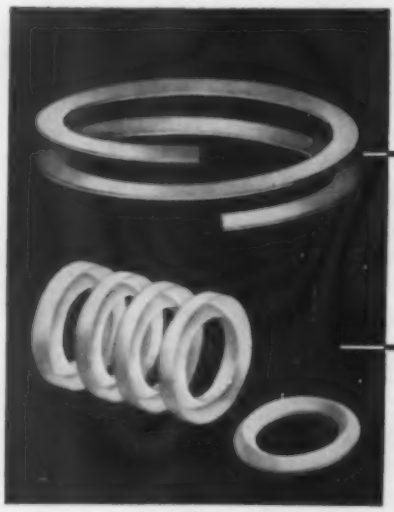
FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.



the Packings impervious to all hydraulic fluids

. . . made of *TEFLON*



Chemiseal hydraulic packings are made of pure duPont TEFLON to outlast other packing materials many times over. Chemically impervious, they have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Require no chemical inspection. Unmatched in anti-friction properties, tough, resilient, non-flammable, long wearing. Service temperature range is from minus 110°F to plus 500°F.

Try Chemiseal back-up rings that greatly lengthen "O"-ring life and prevent extrusion. Available in solid, split and spiral types in all commercial and AN sizes for "O"-ring packings, gaskets and universal fittings. Catalog OB-1152.

Try Chemiseal V-type packings for manual or automatically operated valves. Seal with low gland pressure and operating torque. Supplied with square-end TEFLON adaptors if required. Catalog TP-1053.

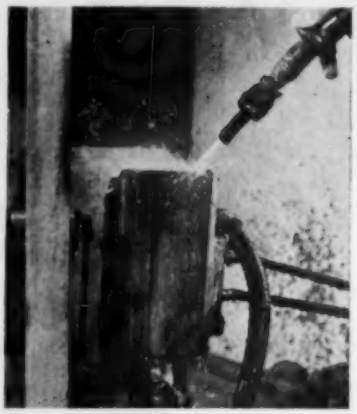
UNITED STATES GASKET COMPANY
CAMDEN 1, NEW JERSEY

USG | **FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS**
Representatives in principal cities throughout the world

BRIEFS continued

Gallons of Water— But Plenty of Air

Equipment used at the Corn Products Refining Company gets a daily washing. Water seepage on the air valves which operate the cylinders to empty starch vats, was quite a problem. Two years



ago the company installed specially built ⅜ inch 4-way solenoid-operated air valves which are gasket sealed with locked in screws so the covers will not loosen or leak. Protecting the solenoid and valve mechanism against moisture, dirt and dust, a battery of these valves has given trouble-free operation under the daily wetting conditions.

Compressed Air Handbook

The second edition of the Compressed Air Handbook, prepared by various groups and individuals of the Compressed Air and Gas Institute, has been published. 418 pp, price $8.00.

Divided into six sections—typical applications of compressed air and gas; air-operated portable tools and rock drills; the compressed air system; positive-displacement compressors; dynamic-type blowers and compressors; and compressed air engineering data and test procedure—the volume shows how to select the proper type of compressed air tool for a spe-

Continued on page 20

Circle 103 on Reader Service Card

Circle 56 on Reader Service Card

Keelavite

PILOT VALVES

NEAT • ROBUST • COMPACT

This new series of solenoid-operated pilot valves is a notable addition to the existing Keelavite range of sequence and interlock control gear. Its field of application in automatic hydraulic machinery is extremely comprehensive by virtue of the numerous alternative standard assemblies. Identical units may be used for electrically controlled piloting duties or small flow direction control. A further range can be mounted directly on to current Keelavite ¾", 1", 1½" and 2" directional valves to form a composite pilot-operated direction control unit. A gasket mounting type is available for attachment to other equipment.

HYDRAULIC DATA

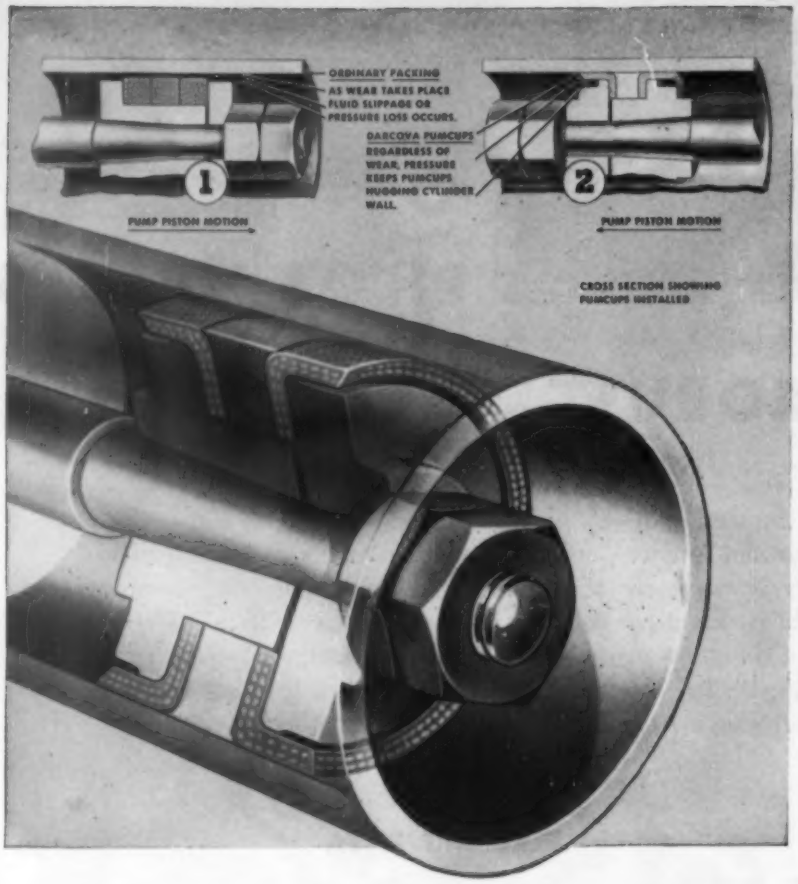
Working pressure 2,000 p.s.i. • Rated Flow 1½g.p.m. • ¼" B.S.P. ports • Internal and external pressure and exhaust connections • Choice of several standard pistons • Send for data sheet giving installation dimensions.

ELECTRIC DATA

Continuously rated solenoid • Single or double acting • 110-440 volt, single phase A.C. supply • Initial Load 350 v.a. • Closed load 60 v.a. • Terminal box rotatable through 360° • Solenoids housed in stove enamelled covers.

KEELAVITE ROTARY PUMPS & MOTORS LTD.
ALLESLEY, COVENTRY, WARWICKS.

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION



DARCOVA PUMCUPS mean EFFICIENCY to cost-minded engineers!

IN air and hydraulic cylinders and reciprocating pumps Darcova Pumcups actually retain full efficiency *throughout* their life span . . . and they outlast most other packings at least 3 to 1!

Special texture engineering plus the Darcova Pumcup principle makes it possible for Pumcups to hold their peak volumetric efficiency. Moreover, Pumcups permit equipment to be operated at reduced speeds, save power, prolong equipment life and eliminate the need for frequent replacement shutdowns.

For less maintenance and lower operating costs find out more about Darcova Pumcups. Write for Bulletin No. 4502 on Pumcups for air or hydraulic mechanisms, Bulletin No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

BRIEFS continued

cific job, its efficient operation and proper maintenance.

Extensively illustrated, including charts and tables, the information presented will help to meet the reference needs of users and prospective users of this basic pneumatic equipment. ▼▼▼

Automatic Sealing Machine Packages Hydraulic O-Rings

To eliminate costly hand sealing and prevent spoilage due to grease, moisture and corrosion, Douglas Aircraft Company Inc. uses this high-speed automatic sealing machine. The company ships thousands of O-rings, used for sealing

hydraulic systems and equipment, to Air Force and Navy installations all over the world. Providing a complete packaging system, the machine seals and prints small bags containing O-rings at speeds up to 7000 bags per hour. ▼▼▼

Two Weeks Intensive Training Course in Basic Oil Hydraulic Power

The National Conference on Industrial Hydraulics and the Illinois Institute of Technology have enrolled 25 men to take this course, June 13-24. The course consists of lectures, discussions, laboratory demonstrations and exercises. Some of the lectures, which cover from basic hydraulic components

Continued on page 24

You're covered across the board

when you use
General Controls' line of quality automatic controls

More and more designers find one simple rule short-cuts their control problems with a quick solution: "Check General Controls first!" For the chances are the complete GC line has the perfect answer to your problems whether it's a time switch or thermostat, a midget solenoid or mighty hydramotor. Get acquainted with the branch office (one of 38) nearest you . . . one source—one responsibility—near at hand—at your service.

K-21 MAGNETIC STOP VALVE

Packless – 2 way – normally closed. For air, gas, steam, water, oil, corrosive fluids. Pressures to 300 psi. Forged brass body. Stainless steel or soft seat.

K-27 MAGNETIC VALVE

Stainless steel for high sulphur fuels, syrups, juices, acids, alkalis, etc. Pressures to 300 psi. Midget size. Multi poised – operates in any position.

K-10 MAGNETIC VALVE

Lever action for higher seating pressure. Excellent general purpose valve for primary fuel, feed water, steam, air. (300 psi max. operating pressure differential.)

K-15 MAGNETIC VALVE

Piloted piston design. Large flow capacity with low pressure drop. For air, gas, steam, oil derivatives. Versatile – with 3 coil classes, 5 seat variations.

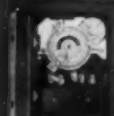
K-123 MAGNETIC VALVE

3 way—for normally open or normally closed directional control and mixer applications—on pneumatic or hydraulic operated devices, machine tools, etc.

K-273 MAGNETIC VALVE

3 way flow or mixer type. Compact, multi poised. For air, water, hydraulic fluids—charging or emptying systems. Normally open or closed. Choice of flow patterns.

TIME SWITCHES



Wide selection for domestic and commercial use – spring wound or motor driven, normally open or closed. For ventilating, lighting, refrigeration, etc.

HYDRAMOTORS

Wide range of types in complete range of pipe sizes and body styles to provide safe, dependable, durable answer to all liquid transfer problems.

AIR MOTOR VALVES

Air-operated diaphragm valve for modulating control. Normally open or closed, 3 way, or slide gates. Selection of various inner valves, body sizes and connections.

General Controls
Automatic
Control Line

1930 25 YEARS 1955

1955 SILVER JUBILEE YEAR

GENERAL CONTROLS

PLANTS: GLENDALE, CAL. • BURBANK, CAL. • SKOKIE, ILL. • 38 BRANCH OFFICES SERVING THE NATION

MANUFACTURERS OF AUTOMATIC CONTROLS FOR THE HOME, INDUSTRY AND THE MILITARY

ECONOMIZE! GET MORE FLEXIBILITY! DESIGN WITH THIS

new, all-pressure line of hydraulic cylinders

Here's a dramatic opportunity to build new, improved performance into your products. This space-saving, weight-reducing line of hydraulic cylinders helps you produce more dependable equipment . . . that looks better . . . and costs less. And — Blackhawk cylinders are available in a complete range of sizes, in push and pull double-acting design, or, in models of the push or pull single-acting type.

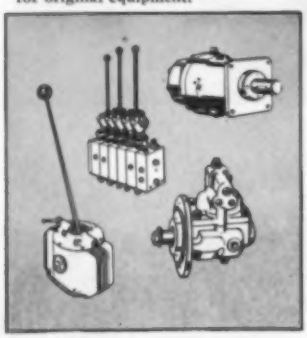
Standards or specials . . . produced by expanded Blackhawk facilities

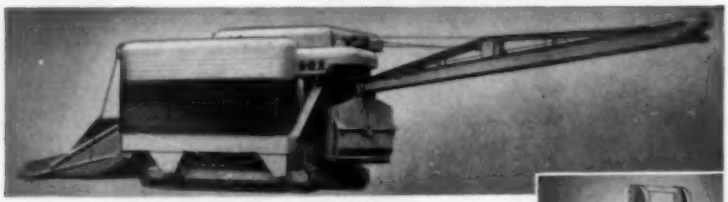
You can make attractive savings when you specify Blackhawk cylinders. That's because of Blackhawk's expanded facilities and continuous production of standard cylinders (and other hydraulic components). What's more, high flexibility of the new cylinder design permits economical production of specials on reasonably long runs.

Our business is hydraulics . . .

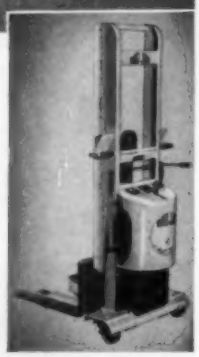
to help power your business

For positive, long-life, low-cost controls, *you can't beat Blackhawk Hydraulics* whether they are pumps, cylinders or valves . . . a single component or a complete hydraulic system. Get the facts now. A Blackhawk Hydraulic Control expert will be glad to analyze your requirements. Or, you can write for detailed engineering literature on Blackhawk hydraulic components for original equipment.





This huge paver features an automatically controlled hydraulic system. The new style Blackhawk cylinders perform an important part in "split-second" control of its mixing and paving cycles.



A Blackhawk "Power-Packer"® self-contained pump, valve and reservoir unit is used on this lift truck.

See Sweet's Product Designer's File.

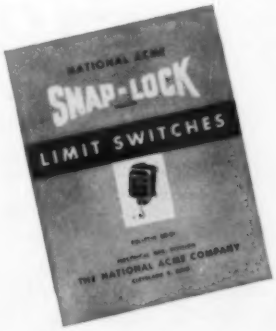
PIONEER SPECIALISTS IN HYDRAULICS FOR 26 YEARS

BLACKHAWK®

BLACKHAWK MFG. CO., HYDRAULIC CONTROL DIVISION • DEPT. M-5265 • MILWAUKEE 1, WISCONSIN

more than 15,000,000 contacts without cost for repairs...

here's the limit switch that spells electrical control dependability in any language



Send for Bulletin EM-51 which shows various types of Snap-Lock Limit Switches available, design features, specifications, wiring diagrams, ordering data—and other National Acme electrical components and controls.

Proven stamina under all kinds of operating requirements (some installations requiring more than 400 contacts per minute) has made National Acme SNAP-LOCK Limit Switches a top-heavy favorite with both design and production engineers.

Mechanical simplicity and ruggedness are the reasons why Snap-Locks have proven an outstanding success in thousands of heavy duty equipment installations. The record shows that in many such cases, they have stood up under more than 15,000,000 contacts.

Built in a variety of sizes and designs including water resistant and special purpose types.

Ask us to assist you in designing these trouble-free switches into your equipment

SEE US AT THE MACHINE TOOL SHOW, SEPTEMBER 6-17
BOOTH NUMBERS 324 AND 705

ELECTRICAL MANUFACTURING DIVISION

The NATIONAL ACME COMPANY

166 EAST 131st STREET • CLEVELAND 8, OHIO

Specify NEW Tannate® heat-resistant packings*

Rhoads has recently developed a new heat-resistant leather for hydraulic and pneumatic applications.
During the last several months, these packings have been tested in the field under a variety of difficult operating conditions.
This new Tannate leather has consistently outperformed the best of the previous leathers under higher temperatures and we are now proud to include it in our line. When specified, they will be supplied at no extra cost.
Tannate heat-resistant packings are recommended for temperatures up to 190° F. continual use or for intermittent use up to 210° F.
Tannate packings will not readily cold flow or score the most highly finished surface. They provide an effective seal against hydraulic oils and many other gases and liquids.
Tannate has a low coefficient of friction . . . is custom impregnated for high or low pressure operation—precision molded and accurately finished to fit snugly against shafts and cylinder walls.

For further details write J. E. Rhoads & Sons, 2100 W. Eleventh St., Wilmington 99, Del.

*Available in U, Vee, Cup, Flange and disc for hydraulic and pneumatic equipment. When ordering please specify Tannate Heat-Resistant packings.

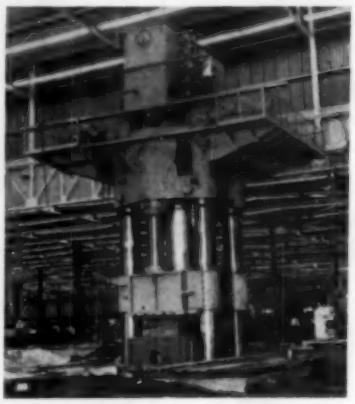
RHOADS
INDUSTRIAL LEATHERS

WILMINGTON • NEW YORK • CHICAGO • ATLANTA

BRIEFS continued

to circuit designs and circuit applications, will be presented by men actively engaged in the oil hydraulic industry. The course was especially designed to benefit shop, maintenance, operating and sales personnel. ▼▼▼

7000-Ton Hydraulic Press



To produce aircraft parts with complicated contours, McDonnell Aircraft Corporation's St. Louis plant has installed this giant press. The base of this press is housed in concrete which extends 15 feet below floor level. The press utilizes a comparatively new method for deep drawing metal parts by a combination cushion and rubber pad process. ▼▼▼

Last Call for Cash Awards

July 1st is the deadline for your entry in the 1955 APPLIED HYDRAULICS Prize Paper Contest. You can submit any paper you feel would make a suitable article for AH. Judges will award $1200 in prizes. Papers which do not win a prize but are considered by the judges as worthwhile will be published and paid for. So your time spent in writing the article will earn you dollars and prestige. Photographs and drawings are very important. Don't put off writing your article. July 1st is almost here. ▼▼▼

Continued on page 26

Wherever throw-off, drip or squeeze-out is a problem...

USE SUNTAC OIL

OIL LEAKAGE MEANS:
higher lubrication costs
messy machines
hazardous oil slicks on the floor

SUNTAC OIL:
cuts leakage
lowers oil costs
minimizes hazardous floor conditions

In addition to its leak reducing properties, Suntac has all the high quality of expensive general-purpose oils. Suntac is fortified against oxidation to assure long oil life and against rust and corrosion to protect valuable machines. And, last but not least, because the leak-reducing agent is 100% petroleum, Suntac leaves no gummy film or residue.

For more information about Suntac, the oil especially made to prevent drip, throw-off and squeeze-out, see your Sun representative or write for your copy of Suntac Technical Bulletin to Sun Oil Company, Philadelphia 3, Pa. Dept. AH-6.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

Teflon*...

Your Best Source Is

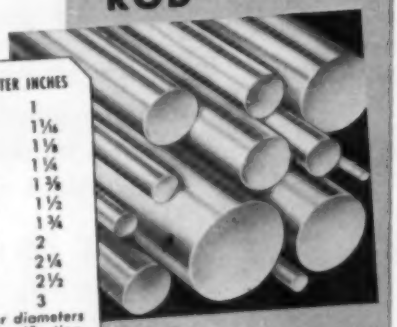
JOHN CRANE

SHEET

Thickness Inches	Nominal Size
1/16	12 x 12
3/32	18 x 18
1/8	24 x 24
3/16	36 x 36*
1/4	48 x 48*
3/8	
1/2 & Up	

* Can be furnished in 1/2 sheets

ROD



DIAMETER INCHES	
1/4	1
5/16	1 1/16
3/8	1 1/8
7/16	1 1/4
1/2	1 3/8
9/16	1 1/2
5/8	1 3/4
3/4	2
7/8	2 1/4
	2 1/2
	3

Other diameters on specification

TUBING

TYPICAL SIZES INCHES	
O. D.	I. D.
3/8	1/4
1/2	3/8
3/4	1/2
1	3/4
1 1/2	1
2 1/2	1 1/2
3	1 3/4

HERE'S WHY: You can order in quantity and in a wide variety of sizes—and be certain of complete uniformity throughout. Our strict density control assures you thoroughly non-porous Teflon—free from any flaws which might possibly affect your end use or product. Dimensions are accurate to your most critical tolerances—no rejects, waste of material or loss of time. You get product purity—Teflon at its best in every one of its remarkable characteristics. Delivery is prompt—you get the quantity you want when you want it.

Since the availability of Teflon, "John Crane" engineers have worked with Industry to successfully solve innumerable problems and develop new applications. *You can benefit from their experience and know-how.*

Characteristics of Teflon

CHEMICAL
Completely inert.

ELECTRICAL
Very high dielectric strength.
Extremely low power factor.

THERMAL
Temperature range
−300° to +500° F.

MECHANICAL
Strong, flexible, weather resistant.

LOW COEFFICIENT OF FRICTION
Absolutely non-stick.

* DuPont Trademark

Request full information and ask for our bulletin, **The Best in Teflon.** *Crane Packing Co., 1805 Cuyler Ave., Chicago 13, Ill.*
In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

JOHN CRANE **CRANE PACKING COMPANY**

BRIEFS / continued

FUTURE EVENTS

July 25-29 and **August 1-5:** Two special programs on Strain Gage Techniques. First week "Fundamentals of Strain Gage Techniques", second week "Applications of Strain Gage Techniques". Massachusetts Institute of Technology, Cambridge, Mass.

August 22-September 2: A program in "Numerical Control of Machine Tools". Massachusetts Institute of Technology, Cambridge, Mass.

September 6-17: The National Machine Tool Show at the International Amphitheatre and the Production Engineering Show at the Navy Pier, will be held simultaneously in Chicago. The Production Engineering Show will include exhibits of hydraulic and pneumatic components, electronic devices, lubricating systems and many others.

September 12-16: "Instrumentation Paces Automation" is the theme of the 10th Annual Instrument Conference and Exhibit of the Instrument Society of America, scheduled for the Shrine Exposition Hall and Auditorium, Los Angeles. In conjunction with this conference will also be an Analytical Instruments Clinic.

October 24-28: The Canadian Tool & Equipment Show, to be held at the Show Mart, Montreal, Canada.

October 27-28: The Eleventh National Conference on Industrial Hydraulics will be held at the La Salle Hotel, Chicago. For reservations write to C. A. Arents, Secretary, Illinois Institute of Technology, Technology Center, Chicago 16.

November 14-18: Chicago Exposition of Power and Mechanical Engineering. Chicago Coliseum, Chicago, Ill. ▼▼▼

Announcing...

THE MASTER CATALOG OF FLUID POWER PRODUCTS

1. **Alphabetical Index of Products and Manufacturers.**
2. **Index to Catalog and Manufacturers Outlets**
3. **Trade Names Index**
4. **Engineering and Technical Data Section.** Section will include specimen pneumatic, hydraulic and electrical diagrams; Fluid Power Circuits; pipe and tubing selection tables; charts of hydraulic fluid characteristics; graphic solution charts and fundamental formulae for selecting components and building circuits; etc.
5. **Where to Buy.** A local buyer's guide or "yellow pages" type of listing of independent outlets, dealers and distributors, listed alphabetically by city and state.

A LONG NEEDED MASTER REFERENCE FILE
(compiled by the editors of *Applied Hydraulics*)

READY OCTOBER 1955

Now for the first time, a single source of reference for engineering and technical data, replete with graphs, charts and tables, a product directory section, backed up by manufacturers' condensed catalog sheets, a trade name index (first time published) and a geographically arranged "Where to Buy It Locally" section (Yellow Pages Directory). First time published.

All this valuable information in a handsome hard cover bound single volume, thumb notch indexed for easy reference. A reference manual of infinite value to designers, engineers and specialists in fluid power application and operation. Covering hydraulics and pneumatics.

CLOSES FOR ADVERTISING
JULY 15, 1955

Manufacturers

Your catalog sheets filed in the MASTER CATALOG are assured of permanent pre-indexed availability in a volume of high reference traffic by the very people whose responsibility it is to select, specify and buy your products. Be sure your customers and potential customers have your condensed specifications for easy reference in this time-saving master catalog. If you have not made your space reservation, write or wire for complete information. (Space users have their listings throughout the Catalog in bold face type.)

Distributors' Advertising Closes July 1st.

Your advertisement in the "Yellow Page Where to Buy It Locally" section in full page, one-half or one-quarter page units, arranged geographically, sells your organization to local area customers and prospects, as well as establishing your reputation as a progressive sales agency to the trade nationally. If you haven't reserved your space, write or wire for rates and information. Most areas already well represented by distributor advertising. Advertisers have their listings in bold face type.

CATALOG INQUIRIES ARE "READY TO BUY" INQUIRIES

Distribution over 12,000 to OEM and Inplant users of fluid power is guaranteed.

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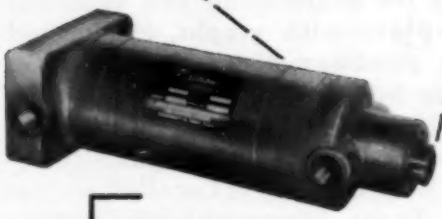
HYDRAULIC CYLINDER

RH Series 2000 P. S. I.

heads are retained by a single screw thread for maximum strength



You get

- Low stress concentration
- Greater resistance to fatigue and shock loading
- Rotatable pipe ports and mounting pads
- Compactness and Alignment Accuracy difficult to obtain in any other type of construction

In choosing Hydraulic Cylinders what are you looking for? *Compactness? Adaptability? Greater efficiency in operation?* You're sure of all three when you specify Pathon Series RH 2000 P.S.I. and Series QH 1000 P.S.I. Hydraulic Cylinders.
Write us today for our catalog. Let us show you why Pathon is rapidly becoming the leader in its field.

Pathon

AIR CYLINDERS

HYDRAULIC DIRECTIONAL CONTROL VALVES

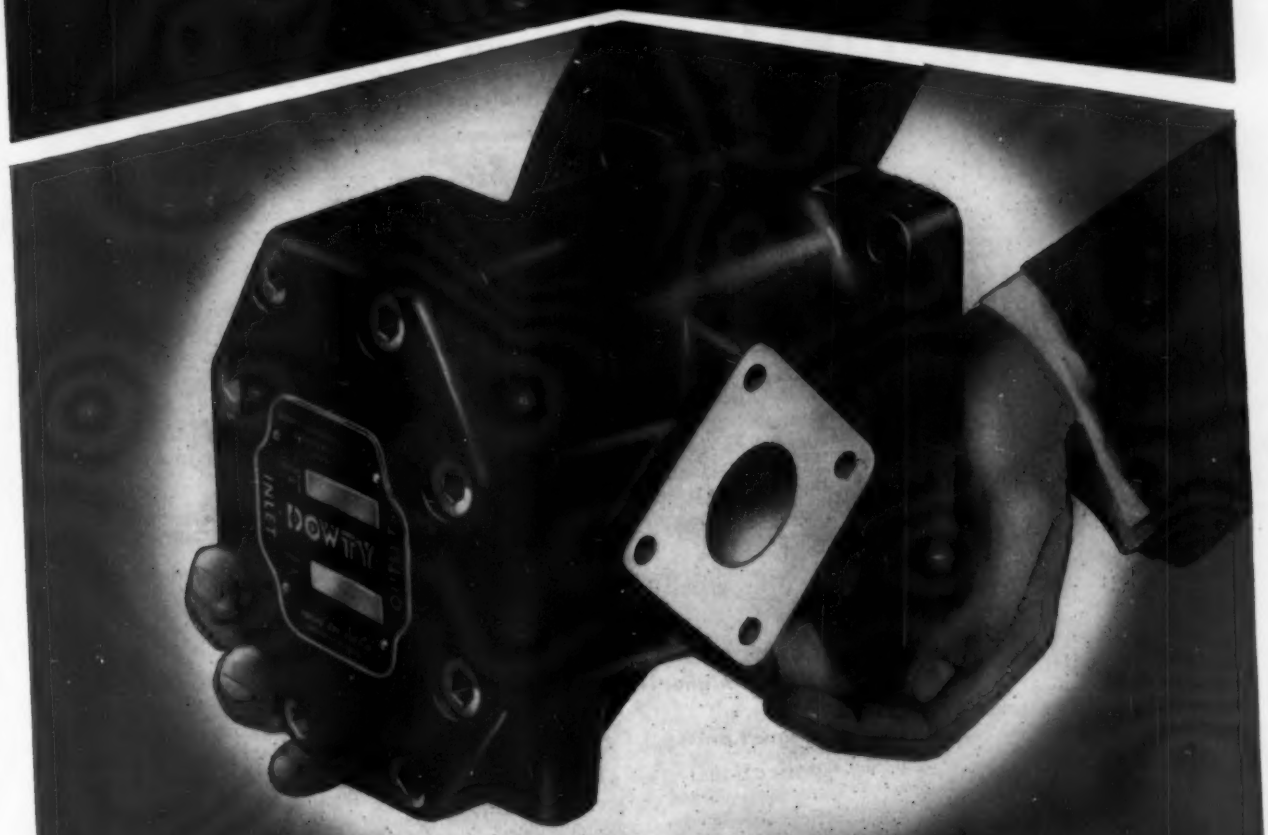
DO A BETTER JOB FOR YOU

Pathon MANUFACTURING CO.

3823 Pacific Avenue Cincinnati 12, Ohio

Circle 77 on Reader Service Card

KEEP THINGS
under better control



Dowty hydraulic components of high efficiency and low cost are keeping heavy work under finger-tip control.

These pumps are available in fourteen sizes from 1 to 30 gals./min. with pressures up to 2,500 p.s.i.

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hydraulics
FOR INDUSTRY

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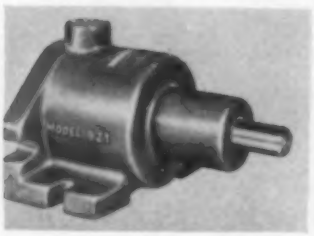
Circle 32 on Reader Service Card

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.



AIR CYLINDER
. . . for universal mounting

Designation: 900 Series

Features: Quick, easy mounting or removal from jigs and fixtures is provided by the one-piece aluminum casting which has a flat base for either horizontal or vertical mounting. Holes are slotted so cylinder can be installed, relocated or removed by merely loosening hold-down bolts.

Specifications: Overall length with piston retracted is 4¾ in. for 1-in. stroke and 5¾-in. for 2-in. stroke. Cylinder is spring-return type. Piston rod extends ⅞ in. in retracted position and operates in oilite bronze bushing. Air connection is ⅛ in. Available in 2-in. bore size.

Modernair Corp.
San Leandro, Calif.

Circle 125 on Reader Service Card

TEST STAND
. . . for higher capacity and pressure

Designation: Model KG-100

Applications: The unit can be used in testing such accessories as relief valves, actuating cylinders, pressure regulators, brake valves, hand pumps, and many other components.

Design: The test stand is capable of delivering 40 gpm at 5000 psi, and incorporates a 20,000 psi hand pump for static and proof pressure tests. And air circuit is included for testing air system components, and the stand also contains a d-c circuit for electrical components. Multiple circuit outlets and control valves permit testing several components simultaneously when the unit is used for production testing. The equipment is especially applicable to the aircraft industry and is approved by the military services.

Greer Hydraulics, Inc.
New York International Airport
Jamaica 30, New York

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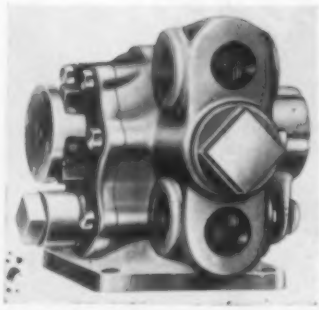


ROTOR ACTUATING VALVE
. . . for mobile equipment

Designation: Type 555-RO

Features: The self-contained mechanism actuates one to three hydraulic cylinders, and is designed for 300 to 1500 psi operation with a capacity of 400 gpm at 1500 psi. Other principal features include exclusive full floating position, built-in bypass to minimize piston creep, and ball-bearing, minimum-friction construction which assures easy operation and long service.

Application: Four-way valve is for positioning hydraulic cylinders in bulldozers, road machinery, mining machinery, hydraulic lifts, earth moving machinery, power tools, farm machinery, and other similar applications.

A. W. Cash Co.
Decatur, Ill.

Circle 127 on Reader Service Card

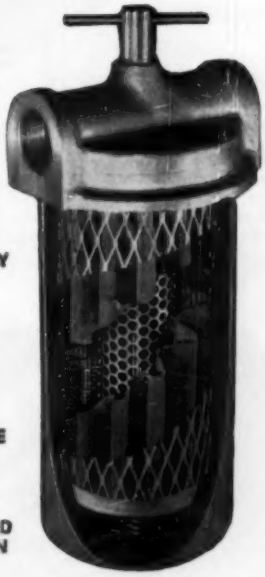
Continued on page 34

SUMP TYPE (Cutaway)

When You Need A Filter— Get The Advantages Of Marvel SYNCLINAL Design

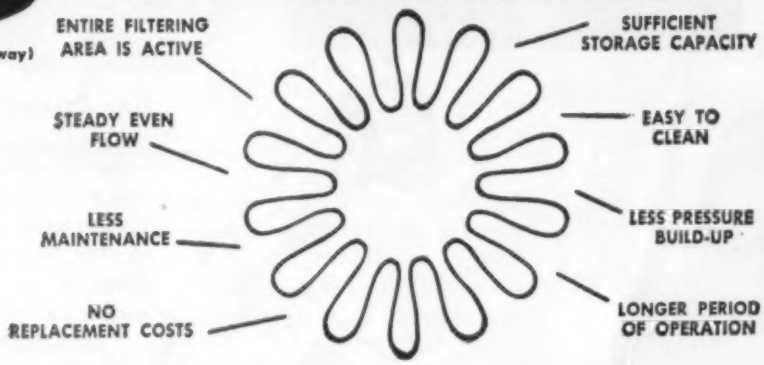
It's BALANCED

For Top Performance!



LINE TYPE (Cutaway)

LOOK FOR THESE IMPORTANT FEATURES



For All Hydraulic and Other Low Pressure Liquid Systems

In the selection of a filter to obtain maximum efficiency and quality, the most important point to consider is a specific type filter that will offer greatest ACTIVE filtering area with ample storage capacity for filtered out particles, rather than total filtering area alone. Over 550 Original Equipment Manufacturers install Marvel Synclinal Filters as Standard Equipment because they are designed to give this all-important balance for greatest efficiency in filtration of liquids in all hydraulic and other low pressure circulating systems. Flow of liquids is maintained at a constant, steady rate of speed produced by the pump which brings about the desired effect of a gentle, evenly distributed accumulation of filtered out particles against the entire filtering surface with less restriction of flow. Result—longer periods of productive operation at minimum maintenance down-time. If this important balance is lacking due to efforts to cram too much filtering mesh for the sake of total rather than active area, filters soon become clogged causing pressure build-up, turbulent flow and in general decreases the efficiency of operating equipment. Depend on Marvel Synclinal Filters For All Your Filtration Requirements.

EASY MAINTENANCE

Both sump and line types may be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be obtained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY

625 W. Jackson Blvd., Chicago 6, Ill., Phones: FRanklin 2-3530 & FRanklin 2-4431

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: AH-6

- ☐ Catalog #106—For Hydraulic Oils, Coolants and Lubricants
- ☐ Catalog #300—For WATER
- ☐ Data on filters for Fire-Resistant hydraulic fluids.

Name ..... Address .....

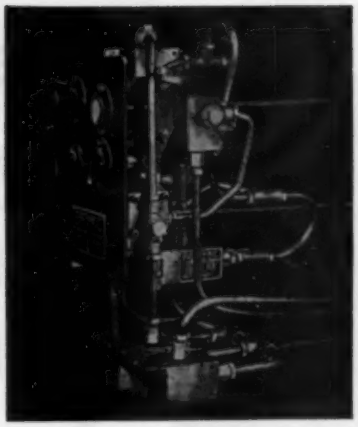
Title ..... City .....

Company ..... State .....

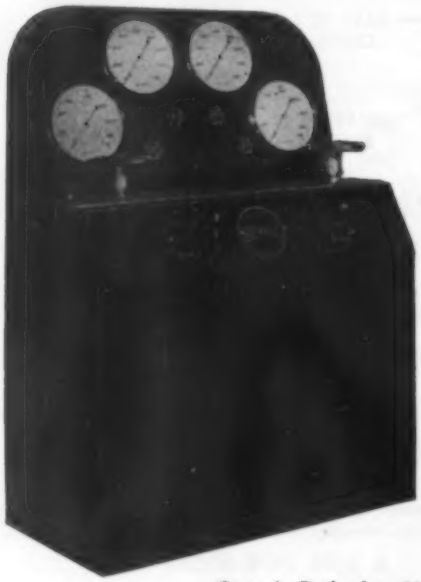
"Fingertip-control" OF HYDRAULIC PRESSURE

WITHOUT SOLENOIDS OR OTHER ELECTRICAL GADGETS

Packaged Unit comprising 22 h.p. motor mounting two Axial Plunger pumps, supply tank and control panel, operating pre-stressed concrete machine.



Fully hydraulic push-button control panel for a 100 ton Cartridge Case Drawing Press.



Control Desk for 500/500 ton Downstroking, Prefilling Press.

Any desired pressure is "at your fingertips" when operating the Autodraulic Control System —and without solenoids! Already giving consistent and unfailing performance throughout N. America in a wide variety of applications, the Autodraulic Control System cannot fail to give increased performance and greater economy in *your* plant.

AUTODRAULIC CONTROL SYSTEMS

WITH HYDRAULIC PUSH BUTTONS

TOWLER BROTHERS (PATENTS) LTD. • RODLEY, NR. LEEDS • ENGLAND

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MACMILLIN ENGINEERING CORPORATION

2125 HOWARD STREET, CHICAGO 45, ILLINOIS

Ambassador 2-1191

Circle 101 on Reader Service Card

Circle 88 on Reader Service Card

TINY TITAN

Automatically controls hydraulic systems *up to 1000 p.s.i. ...up to 5.4 g.p.m.!*

The Skinner V10 *hydraulic* valve was especially designed for the age of automation. It is small, but as powerful as Hercules . . . built to give dependable, trouble-free service through

millions of cycles!

The V10 is a spring-loaded, direct-acting slide-type valve with internal parts made of stainless steel. Its precision-honed bore and centerless-ground, heat-treated plunger guarantee controlled leakage — at pressures up to 1000 p.s.i. and flow up to 5.4 g.p.m.! It is especially suitable for operating cylinders in machine tools, door openers, etc.

Like all Skinner solenoid-operated valves, the V10 is furnished with highest grade, varnish-impregnated "Nema Class A" coils. Molded, waterproof coils are available on request.

SPECIFICATIONS

Pressure Rating — 0-1000 p.s.i. [safe maximum (burst) pressure: 3000 p.s.i.]

Type — two- or three-way, normally open, normally closed, or directional control.

Effective orifice diameter — 1/32"

Pipe Size — 1/8" NPT (also available with ports drilled into bottom of valve body for direct mounting).

Electrical Outlet — Grommet-type or 1/2" NPT conduit (housings can be rotated 360°).

Voltages — all common AC and DC voltages.

Maximum Power Consumption — AC — 10 watts; DC — 12 watts.

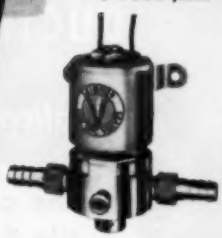
Do you have a solenoid valve problem? Call in a specially trained Skinner resident engineer— he'll tackle your problem immediately.

GENERAL SERVICE & VACUUM
V5 Series
2- & 3-Way
0-1000 p.s.i.

MINIATURE CUT-OFF
V2 Series
2-Way
0-250 p.s.i.

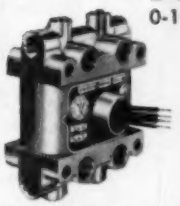
QUICK EXHAUST
(extra fast cylinder return)
QV5-3 Series
3-Way
0-150 p.s.i.

HI-PRESSURE HYDRAULIC
V10 Series
2- & 3-Way
0-1000 p.s.i.



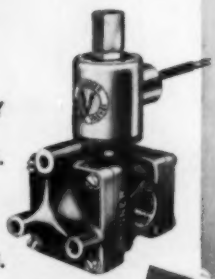
SANITARY
V4 Series
2-Way
0-20 p.s.i.

EXPLOSION-PROOF
X5 Series
2- & 3-Way
0-1000 p.s.i.



ALL-PURPOSE FOUR-WAY
V9 Series
4-Way 0-150 p.s.i.

HI-FLOW INDUSTRIAL
M Series
2- & 3-Way 5-150 p.s.i.



World-Wide Representation — Immediate Delivery on Standard Valves

SKINNER SOLENOID VALVES

SKINNER ELECTRIC VALVE DIV.
The Skinner Chuck Company
105 Edgewood Avenue, New Britain, Conn.

☐ Please send me your new General Catalog.

☐ Please have a Skinner representative call on

Date.....

Name.....

Company.....

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City.....Zone....State.....

SKINNER ELECTRIC VALVES

® THE CREST OF QUALITY

—you'll want to know about the

ANCHOR

DUCTILE SLEEVE FEATURES

for

Applications of Extreme Pressure

The advantages of Anchor Ductile Sleeve Type couplings are simple as A B C —

A. Ductile Sleeve is imbedded into the mesh of the outer wire braid of the hose thru external swaging of coupling shell.

B. Ductile Sleeve metal forms into the internal grooves of the coupling shell. This virtually makes the coupling become a part of the steel re-inforcing wires of the hose.

C. Positive oil seal is accomplished by long uniform grip of grooved steel insert in contact with tube of hose.

We have them in full range of sizes. Minimum burst pressures up to 28,000 lbs.

We also have many other types of hose assemblies to choose from.

Let me send you the full story — Write!

ANCHOR COUPLING CO. INC.

349 North Fourth Street • Libertyville, Illinois

Branch Offices: Dallas, Tex.; Plymouth, Mich.

New Products / continued

PRESSURE SWITCH
. . . for gasket mounting

Designation: Series SG1-02
Features: Improved performance is achieved with special design provisions for increased freedom of action. A special sub-plate is available to permit mounting in applications where a machined pad is not provided. Unit provides ease of installation, maintenance, and replacement when applied to hydraulic presses, production and processing machinery, machine tools and other industrial hydraulic equipment.

Specifications: Available in three models for wide pressure range coverage: 100 to 1000 psi, 100 to 2000 psi, and 500 to 5000 psi. Pressure settings are adjustable throughout the complete pressure range of each model. Nominal current ratings are 10 amperes at 110 volts for the 100 to 1000 psi size, 5 amperes at 220 volts for the 100 to 2000 psi size, and 3 amperes at 440 volts for the 500 to 5000 psi size.

Vickers, Inc.
Detroit, Michigan

Circle 128 on Reader Service Card

DIRECT LIFT SOLENOID VALVE
. . . combines simple construction, rugged housing

Designation: Bulletin 8030A
Design: The only moving part in this new valve is a stainless steel core and composition disc housed in a heavy duty forged brass body. The simple construction and operation of the valve permit easy main-

Continued on page 36

Circle 8 on Reader Service Card

Why limit yourself to "STOCK" sizes?

Hannifin can ship the cylinder you need within 48 hours!

(NEW AND EXPANDED PRODUCTION FACILITIES MAKE THIS POSSIBLE)

Any mounting style in:

Series "A" Square Head Air Cylinders—1½" to 14" bore
Series "H" Square Head Hydraulic Cylinders—1½" to 8" bore
Series "LW" Cast Head Air Cylinders—1" to 12" bore

Strokes
As specified to 60"

Rod Ends
Catalog standards, including standard alternates.
Most special rod ends require only 24 hours longer.

Cushions
Either or both ends if required

Quantity
Normally any quantity you need for rush jobs.
For large quantities specify your requirements.

order by phone

When the need is urgent
call long distance.
Experienced sales engineers
will handle your order

CALL HANNIFIN CYLINDER SALES
Des Plaines Number—VAnderbilt 4-0151
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Do you have these two newest Hannifin catalogs?

BULLETIN 113—
Series "H"
Hydraulic Cylinders

BULLETIN 213—
Series "A"
Air Power Cylinders

Write for your copies

HANNIFIN

Hannifin Corporation, 545 S. Wolf Road, Des Plaines, Ill.
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

Back of the JOHN DEERE No. 55 Combine is a story of...

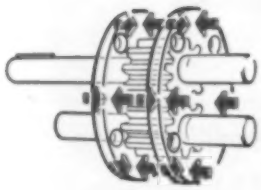
Oil Power

HYDRECO
Oil Power

The famous HYDRECO Four-Bolt design Hydraulic Pump provides Oil Power on the John Deere No. 55 Self-Propelled Combine to position the Auger Platform and control the Variable Speed Drive. This model 1506 Pump delivers 3.3 gpm at 1200 rpm with pressures to 1500 psi... other models to 130 gpm.

Build the hydraulic circuit around the dependability of HYDRECO components. More and more design engineers find this premise leads to successful performance in service whether the application be farm equipment, machine tools, materials handling or construction machinery.

HYDRECO Oil Power... Pumps, Motors, Valves and Cylinders have one important characteristic in common . . . they're *dependable*. And the engineering that contributes this dependability may be relied upon to make significant contributions to your present and projected hydraulic problems.



Pressure Balanced wear plates maintain a fixed clearance between wear plates and gear faces regardless of pressure. This feature in HYDRECO Pumps and Motors minimizes oil slippage and power loss... volumetric efficiency and mechanical efficiency remain high!

Write for brochures on HYDRECO Pumps, Motors, Valves and Cylinders.

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1104 EAST 222nd STREET • CLEVELAND 17 • OHIO
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

New Products / continued

tenance of internal parts without removing valve from the line. It can be mounted in any position to facilitate electrical connection.

Features: The normally-closed valve requires only 10 watts to operate. When energized, the solenoid

lifts the core and attached disc directly off the seat. A closing spring returns the core and disc to a tightly-seated position when the solenoid is de-energized.

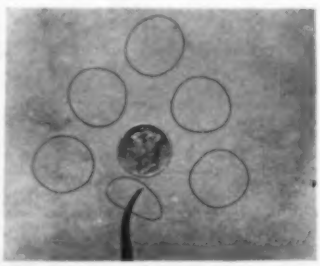
Specifications: Valve is available in ⅜ and ½ inch pipe sizes.

Applications: For control of low pressure up to 7 psi.

Automatic Switch Co.
Orange, New Jersey

Circle 129 on Reader Service Card

O-RINGS
. . . with .015-inch cross section



Features: O-rings are molded from silicone rubber with cross section about the same as a hog's bristle. These meet the needs for miniaturization especially in instrumentation.

Bacon Industries, Inc.
Watertown, Mass.

Circle 130 on Reader Service Card

SELF-SEALING SCREWS
. . . eliminate thread sealing

Design: Fasteners use principle of sealing mating surface to screw head. This is accomplished with an O-ring in the specially designed O-ring groove under the head. Friction between the seal ring and the fastener has been eliminated by the use of a thin Teflon washer between the O-ring and the fastener head. The rubber flows evenly in all directions and permits the fastener to be reused many times for access doors or drain plugs. The screw head which is oversize to accommodate the O-ring provides greater tensile strength, greater sealing capacity under shear action, and a greater sealing area.

Aero Bolt & Screw Co., Inc.
Stamford, Connecticut

Circle 131 on Reader Service Card

CYLINDERS
. . . for industry and agriculture

Features: Cylinders are constructed of roller-burnished seamless mechanical tubing with aluminum pistons and heads. A wide variety of end fixtures, packings, and accessories are available. Cylinders can

be supplied from 1½ to 5-in. bore with strokes to 10 ft. Agricultural cylinders have a working pressure of 1500 psi and industrial cylinders have a working pressure of 2500 psi. Change-over can be made by replacing O-ring seals with industrial packing.

Hemco Mfg. Co.
Argonia, Kansas

Circle 132 on Reader Service Card

AIR VISE
. . . speeds operations

Designation: Model 60

Design: The ram of this air vise is driven by a long-life, multiple type diaphragm instead of a piston, eliminating packing glands, cross head, friction losses, air leakage, and need for constant lubrication. Heavy duty diaphragm is rigidly clamped between precision ground surfaces of rugged iron castings.

Continued on page 39

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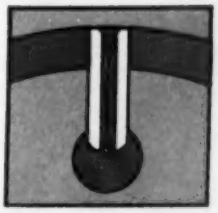

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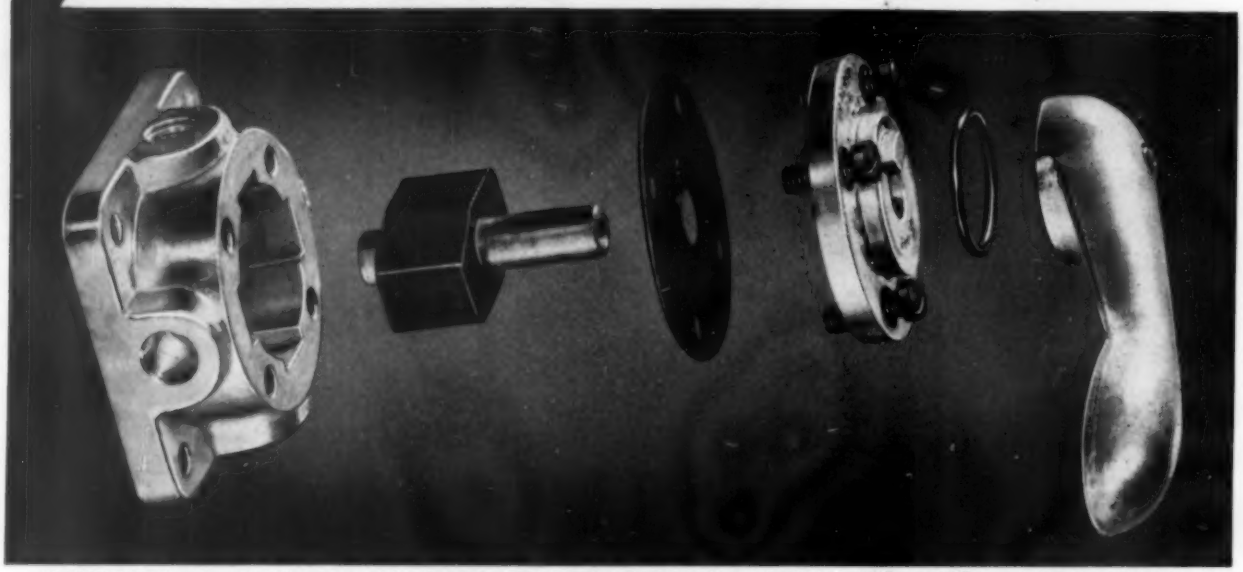

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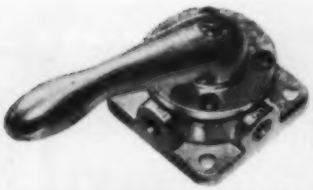

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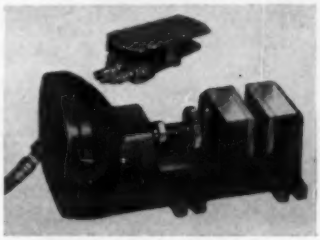

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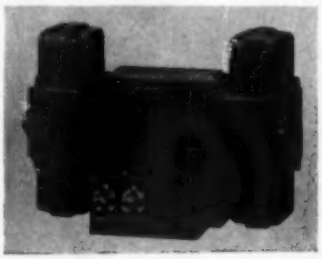

electrically operated or with electrically operated reversing control and cam operated feed selector. The electrical portion of panels is solenoid-controlled, pilot-operated providing the advantages of small solenoids with low current requirements, smooth operation, and compactness.

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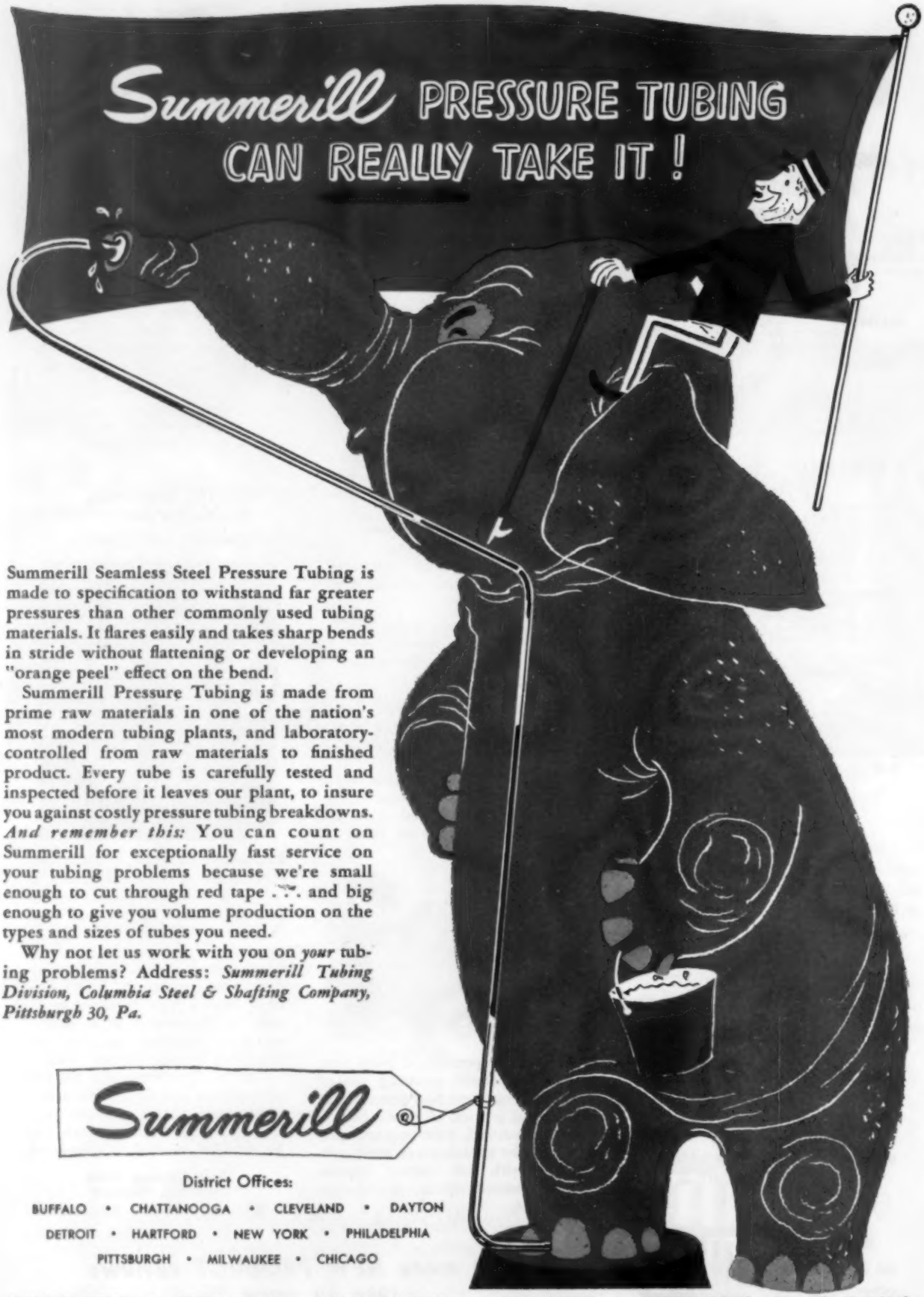

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Useful Literature

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RELIEF VALVES . . . Revised catalog sheets listing new part numbers assigned to ¼-in and ⅜-in pilot type relief valves to simplify specifying models of different pressure ranges are now available from Fluid Controls, Inc. The valves which are designed for maximum accuracy are available with either standard pressure adjustment or hand knob. The valves are recommended for material handling equipment, machine tools, and mining machines. Operating performances of the valves, cross-sectional drawings, and typical installation diagrams are included in the new sheets.

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AIR COOLER . . . and moisture separator are featured in Bulletin 711 issued by R. P. Adams Co., Inc. The bulletin also gives a procedure for computing the moisture content in any given system. The aftercoolers assure air within 10°F of the cooling water permitting efficient removal of the moisture by the separator. The literature shows construction and gives specifications for the equipment and indicates several applications. Also included is information on the company's air filter with a description of its operation and features.

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JIC STANDARDS . . . A new revised up-to-date issue of the JIC Hydraulic Standards for Industrial Equipment is now available from Miller Fluid Power Co. The new issue presents the standards in complete, unabridged form including all revisions made at the January 1953 meetings of the group. Also included are the recommended practices on hydraulic packings and seals, examples of packing code identification, a sample circuit using JIC symbols, a glossary of terms, and other useful information.

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PACKING LUBRICATION . . . Technical Bulletin No. 10 recently released by Goshen Rubber Co., Inc. presents the problems of packing lubrication and various solutions. The bulletin describes a process called Gorlube which incorporates a lubricant into the working surfaces of rubber packing, O-rings, valve seats, resilient mountings, and similar parts. The characteristics and test results of this process are given with application recommendations. The process should be considered a supplementary lubricant to enhance the performance and life of rubber parts operating in commonly used hydraulic fluids, liquid lubricants, or greases.

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ELECTRIC MOTORS . . . Booklet 1856 issued by U. S. Electrical Motors, Inc. describes their new Type H open motor. By increasing precision of manufacturing processes, with tolerances to closer limits and improved electrical characteristics, the new motor is more compact than previous models. An outstanding feature is its new fully protected design. The booklet points out that the motor conforms with the new NEMA specifications, and exceeds previous models in horsepower per cubic inch. The slot design has been improved and the asbestos-protected windings have been reinforced and strengthened.

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FIRE RESISTANT HYDRAULIC FLUID . . . Because of the many applications in the steel industry where use of a fire resistant hydraulic fluid is imperative for safety reasons, a special leaflet on the subject has been released by E. F. Houghton & Co. Emphasized in the leaflet are the lubricity and oxidation stability of their non-foaming, water-base fluid. It is non-toxic, will not attack hydraulic packings and can be pumped and used at low temperatures.

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VARIABLE VOLUME PUMP . . . Denison Engineering Co. has published Bulletin P-7 describing their variable volume vane pump for pressures up to 1000 psi. The bulletin discusses features of the pump such as variable delivery control, compensator control, remote control, and venting. The pump replaces a conventional hi-lo pump installation, eliminating the unloading valve and check valve required in that installation. Circuits are shown in the bulletin comparing these and other circuits. The pressure compensated pump delivery remains constant within approximately ±5% regardless of pressure fluctuations in the circuit or variations in pump shaft speed.

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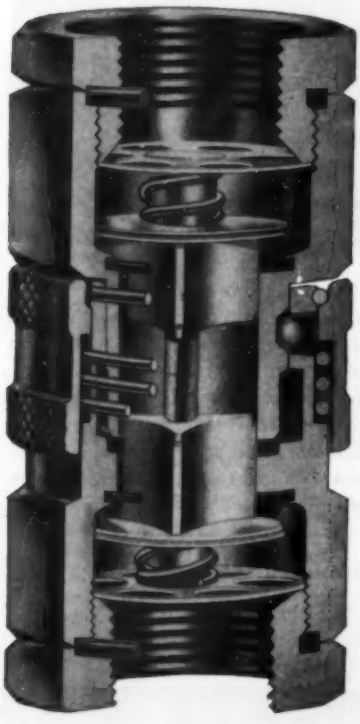
and NO DANGEROUS SPRAY



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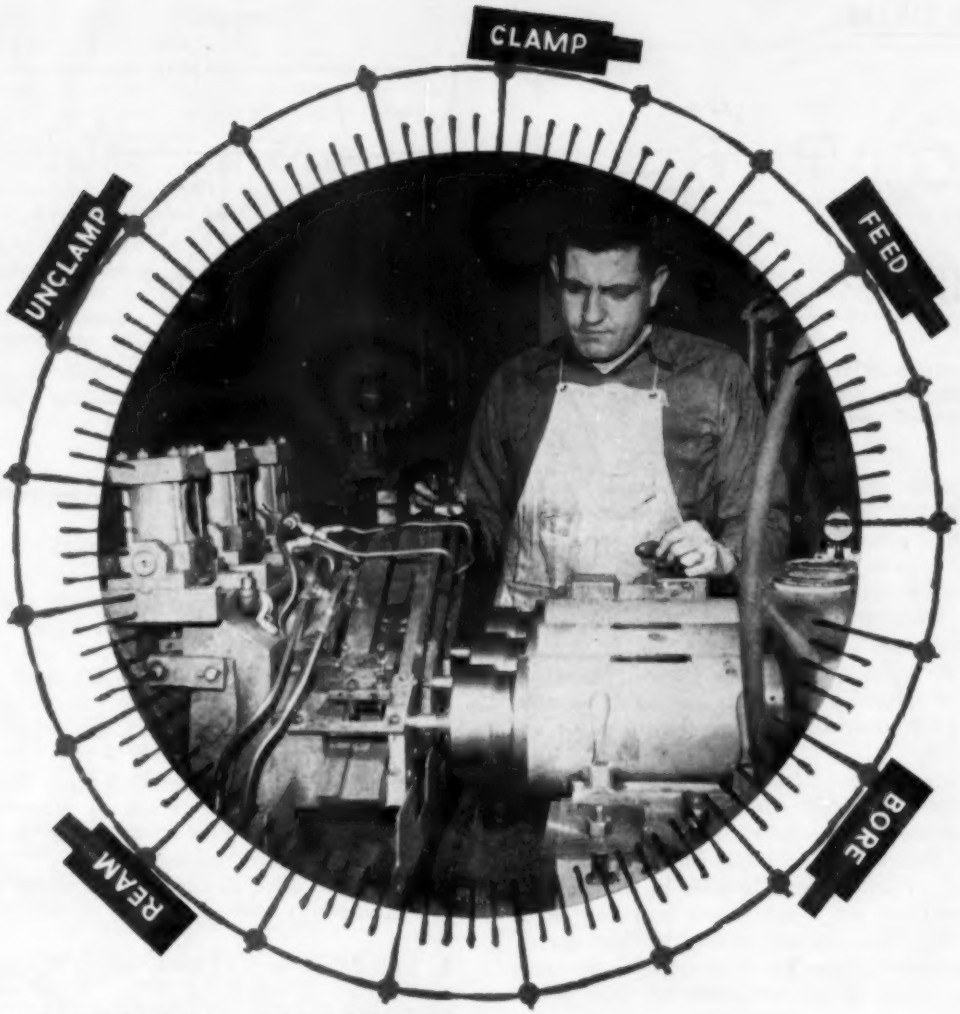


MOTOR TIMERS *for Dwell Control*

• By M. G. Saake

WHEN an automatic machine must dwell during one of its operations, the automatic-reset timer enters the electrical circuit to provide the adjustable delay. Many different designs of timers are available and the importance of correct selection is emphasized when we consider that the loss in production from a single timer failure can be many times the cost of the timer.

The timers described in this article are of the automatic-reset type and incorporate a synchronous motor, solenoid-actuated clutch, and contacts. Such timers have a wide range of timing intervals and provide accurate and consistent repeat timing. These timers have three phases of operation—reset, timing, and timed out. In reset, the clutch solenoid and motor are de-energized and all contacts are in their normal position. In a simple type of timer, a snap switch is actuated at the end of the timed interval. When the clutch solenoid is de-energized, the timer resets and the switch is released. Another more versatile timer has its contacts controlled by the clutch solenoid as well as the motor. In such a timer, the contacts can be adjusted to be open or closed in each of the three timer phases. The

M. G. SAAKE, *C. H. Ribble Company, New York City.*

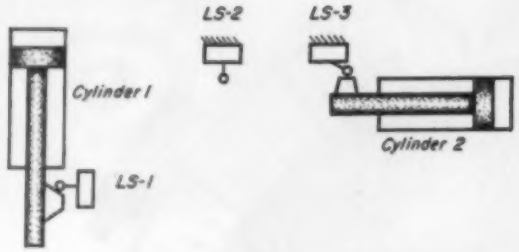


FIG. 1. THIS SIMPLE CYLINDER arrangement is applicable to production machines with a synchronized transfer operation.

timer motor may be energized through one of these contacts or the motor may be energized by some other action. Thus the timer can serve as a relay prior to its action as a timer.

When the motor is energized, the timing phase begins. When the motor stops after the preset time, it actuates or deactuates the contacts according to the arrangement of the timer. This is the timed out phase and it lasts until the solenoid clutch is de-energized resetting the timer for another cycle.

Where a sequence of linear motions is required, the problem is readily solved by the selection and application of limit switches. These act as "pilots" for the electrical components which in turn operate air or hydraulic cylinders. In this manner the operations are synchronized and can occur repeatedly. These operations may be "end-to-end" with one starting when the other stops, or they may overlap, either being the result of limit switch actuation.

Figure 1 illustrates a common timing problem. Cylinder 1 moves down, dwells, and then retracts. Cylinder 2 then moves forward and back to com-

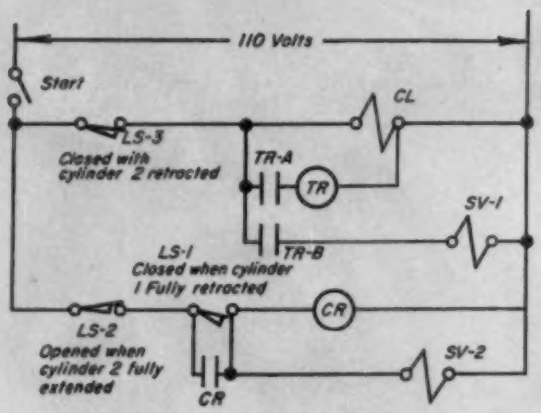


FIG. 2. ELECTRICAL SCHEMATIC for control of cylinders in Figure 1.

1. Closing Start switch energizes timer clutch CL through closed limit switch LS-3.
2. Timer contacts TR-A and TR-B close energizing timer motor TR and solenoid valve SV-1. Cylinder 1 moves down and dwells.
3. After the preset time, motor stops and opens contacts TR-A and TR-B de-energizing motor and solenoid valve. Timer solenoid clutch remains energized and timer is in timed out phase.
4. De-energized valve allows Cylinder 1 to retract. In its retracted position cylinder 1 actuates limit switch LS-1 which in turn actuates relay CR.
5. Contact CR closes, maintaining relay CR circuit and energizing solenoid valve SV-2 to extend Cylinder 2. This allows limit switch LS-3 to open resetting timer.
6. Cylinder 2 moves forward until it actuates limit switch LS-2 de-energizing relay CR and solenoid valve SV-2.
7. Cylinder 2 retracts and closes limit switch LS-3. This energizes timer TR to repeat the cycle. This cycling continues until the Start switch is opened.

Fig. 3. DWELL TIME for the die and the injection ram are timer controlled.

FIG. 4. ELECTRICAL CIRCUIT FOR INJECTION MOLDING.

1. Pressing Start switch energizes timer clutch CL-1. Contact TR-1A closes maintaining clutch circuit and energizing Close-Die valve. Die closes.

2. At the same time, contacts TR-1B open. As the die moves from its full open position, limit switch LS-1 closes in preparation for the Die-Open cycle.

3. When die is fully closed, limit switch LS-2 closes and energizes timer TR-2. Contacts TR-2A close energizing Injection-In valve. Injection ram moves forward and dwells.

4. After preset period set on timer TR-2, contacts TR-2A open de-energizing Injection-In solenoid valve, and contacts TR-2C close energizing clutch coil of counter and motor of timer TR-1. Timer TR-1 timed interval now begins.

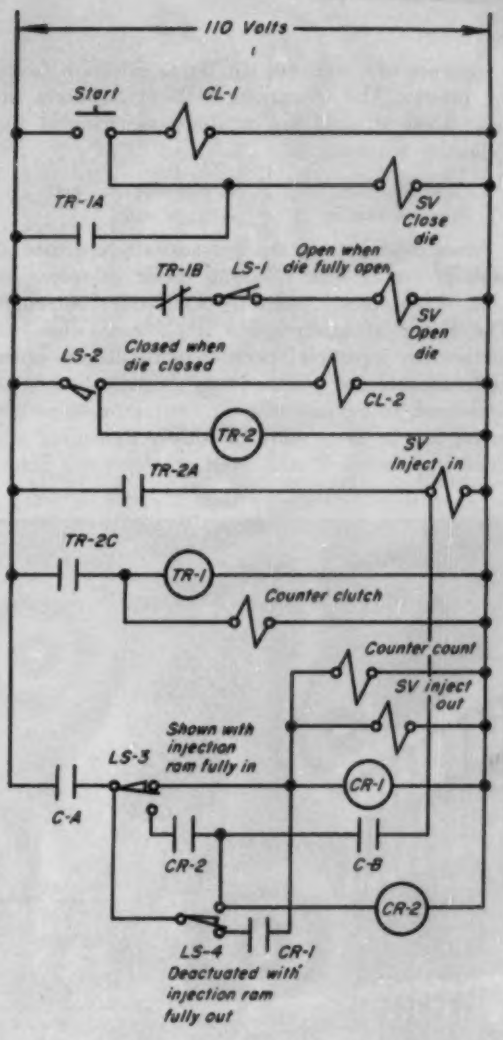
5. Counter contacts C-A and C-B close. Contact C-A energizes Injection-Out valve, relay CR-1, and counter count coil. These are maintained through contact CR-1 in series with limit switch LS-4.

6. When Injection ram is fully out, limit switch LS-4 is deactuated. This de-energizes Injection-Out valve, relay CR-1, and the counter count coil. One count is thus recorded. This also energizes the Injection-In valve and relay CR-2. These are maintained through contact CR-2 in series the limit switch LS-3. Injection ram again moves in.

7. When Injection ram is fully in, limit switch LS-3 is deactuated initiating the same action as described in 5.

8. Thereafter the pre-pack action of the Injection ram continues until the complete strokes correspond to the number set on the counter dial. At this point the pre-pact counter counts out and automatically resets. Both contacts C-A and C-B open.

9. Meanwhile timer TR-1 has been timing and when it times out contact TR-1B closes. This energizes the Die-Open valve. The press opens and when fully open limit switch LS-1 is actuated de-energizing Die-Open solenoid valve.



plete the cycle. When cylinder 2 is fully retracted, cylinder 1 again moves down and the operation continues in this manner until the start switch is opened.

Figure 2 shows the electrical schematic circuit for this operation. As a matter of good practice, cylinder motion should not be part of the timed function, as the time of motion tends to differ with each operation. In this particular application, cylinder 1 is actuated at the same time as the timer, so its movement is included in the timed interval and inaccuracies are introduced. If greater accuracy were required, a normally open limit switch could be connected in series with the timer motor. This would be actuated with cylinder 1 in the fully extended position. Although the timer clutch would be energized when the start switch was closed, the timer would first act as a relay and would energize solenoid valve SV-1. Timing would not begin until cylinder 1 was in its fully extended position, at which point the limit switch would close.

This illustrates the flexibility of this circuit and others similar to it. By minor circuit changes the delay could take place on either the extend or retract stroke of either cylinder 1 or 2.

INJECTION MOLDING CIRCUIT

We can now apply these elementary design principles in a more complicated circuit for the control of injection molding presses such as that shown in Figure 3. These are used for thermosetting plastics to make television cabinets, large grilles, and furniture. Die casting machines have

a sequence of operations similar to injection molding presses. The operations of both machines involve basic straight line motions occurring in the following sequence:

a. Close die
b. Injection ram in
c. Injection ram out
d. Open die

Since most presses are hydraulically operated at high pressures with resulting thrust measured in tons, this sequence must be accurately controlled. The factor of safety gains importance when we picture the injection operation with the die open. Hot, uncontained plastic is an extreme hazard to personnel. In the case of a die casting press, molten metal can be even more physically damaging and must be controlled with even greater care. Safety precautions must be provided in the electrical and mechanical interlocking of the control system to achieve maximum safety.

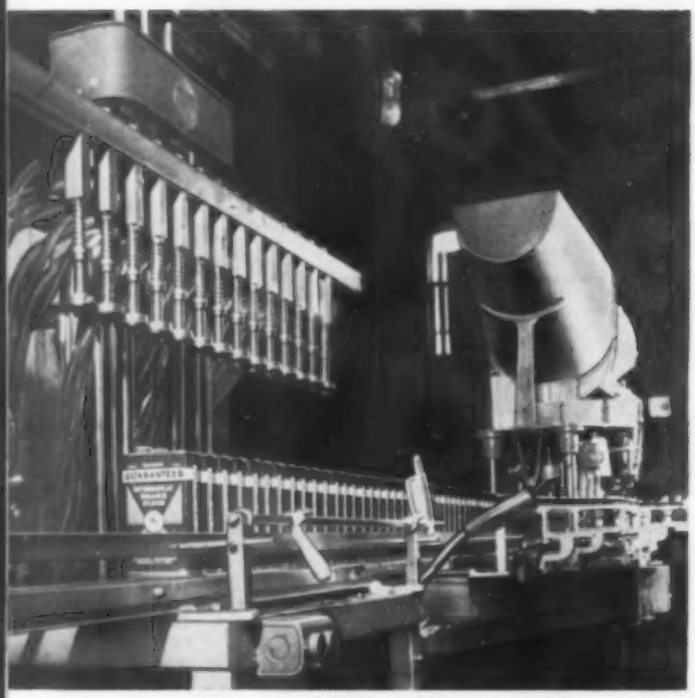


FIG. 5. LIQUID FILLING machine was made automatic with an air cylinder controlled by a timer.

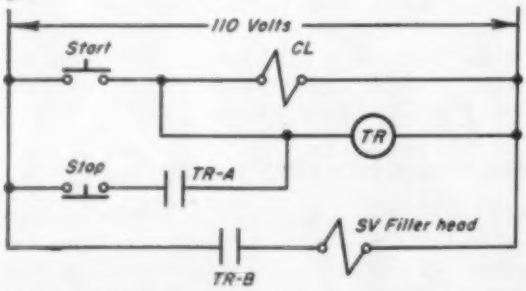


FIG. 6. LIQUID FILLING machine circuit provides cylinder dwell while nozzle head is lowered.

Dwell periods are required on both the die closing and the injection strokes, and on some presses the injection ram must make several pre-pack strokes. The electrical circuit for a machine having several pre-pack strokes includes a counter for automatic operation on a single-cycle or repeat-cycle basis. Automatic recycling requires a delay when the press is fully open. A timer provides this delay before the press again closes, and is the equivalent of the pushbutton start of a single cycle machine. Solenoid valves control the die and injection rams, and limit switches fixed at proper locations on the press, control the cycle and maintain press safety.

The object of any control system is simplicity—the reduction of components to a minimum—while including all features necessary to successful, safe, operation. While relays are used where required, in the circuit of Figure 4 full advantage is taken of the timer and counter contacts so that the need for numerous additional relays is minimized.

It will be noted that timer TR-1 acts first as a relay and then as a timer. This timer and the counter contact C-B in the Injection-In valve circuit has eliminated the need for two additional relays. It will also be noted that the press must be fully closed so that limit switch LS-2 is closed before the injection stroke can take place. The injection dwell takes place *before* the timing interval of timer TR-1 begins.

Small presses of this nature have high productivity and operate on short cycles. This control circuit provides rapid and repetitive cycling and uniform product output.

TIMING FOR A FILLING OPERATION

The liquid filling machine in Figure 5 is an example of the application of pneumatic and elec-

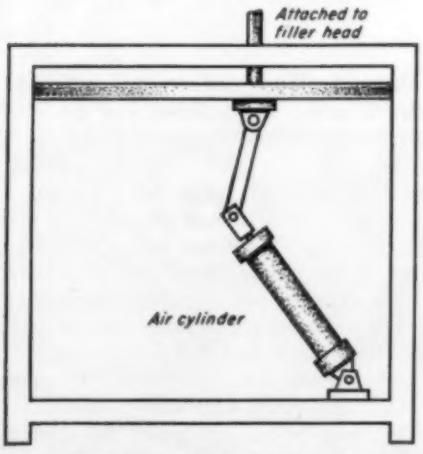
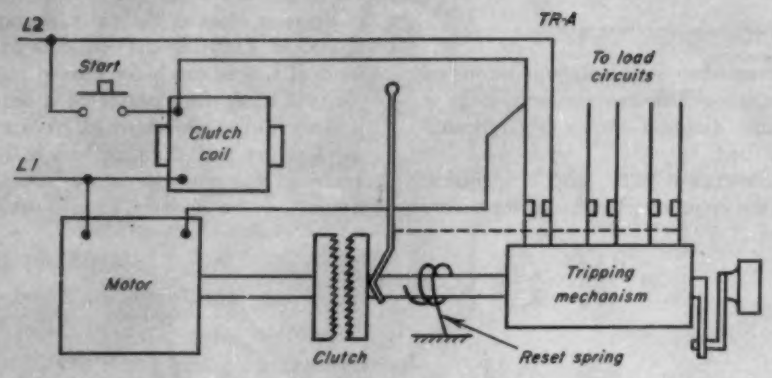


FIG. 7. AIR CYLINDER MOUNTED in machine base lowers and raises nozzle head.



AUTOMATIC-RESET TIMERS **are the "brains" for machines which must follow a fixed sequence of operations with preset dwells in certain phases. The motor-driven timer consists of a synchronous motor driving a tripping mechanism through a solenoid-actuated clutch. When the solenoid is energized, the clutch is engaged and certain contacts are actuated depending on the arrangement of the timer. The motor may be energized through a set of these contacts or may be energized through some other source. When the motor stops, certain contacts are deactuated depending on the arrangement, and when the clutch is disengaged all contacts are returned to their reset position.**

trical components to a manual machine. In the manual version of this filling machine, a lever lowered and retracted the multiple filling head. Since this was a straight line motion, it was relatively easy to add an air cylinder to lower and raise the nozzles as indicated in Figure 7. The cycle is made automatic by adding a timer. This liquid filler is now manual or automatic in operation as desired. In production runs the automatic cycle is used to reduce operator fatigue, increase output and efficiency, and eliminate the need for a skilled operator. These all serve to reduce costs and are decided advantages over the hand-operated operation. Should the automatic system require servicing, releasing a clutch permits manual operation without interruption to vital production.

The electrical control shown in Figure 6 is simple. The operator presses the Start switch and timer contacts TR-A and TR-B close. Contact TR-A maintains the timer circuit and contact TR-B energizes the solenoid valve. Timing begins and the cylinder extends lowering the multiple filling head. The containers are filled accurately and uniformly to any predetermined level by a vacuum system which prevents over-filling of the individual containers. The timer dial is set for an interval slightly longer than the filling operation. When this period is reached, the timer times out and resets restoring all contacts to the position shown in the diagram. The four-way spring-loaded solenoid valve returns to its original position and the cylinder retracts. The nozzles raise and the equipment is ready for the next cycle of operation.

The considerations leading to the selection of the air cylinder were the availibility of air pressure, the force required to raise and lower the filling head, and the mechanical linkage space requirements. These fix the bore, stroke, and mounting of the cylinder. The timer range is selected on the basis of the maximum cycle encountered.

EMBOSSING PLASTIC SHEETS

The semi-automatic process for forming or embossing plastic sheet consists of several straight-line motions ideally suited to air operation. Basically the process consists of heating the plastic sheet over a large bed and forming or embossing by evacuating. A typical machine is diagrammed in Figure 8. The unit is divided into three parts, with forming beds on each end and a radiant heater in the center. Air cylinders move the heater on rollers to either forming bed. Two heater cylinders are used—one to position the heater over each forming bed. Two latch cylinders are used to latch the heater cylinders moving the heater over the forming bed in readiness. A bed cylinder raises each forming bed under the heater.

The electrical circuit is shown in Figure 9. The cycle is initiated by closing the pushbutton Start switch, and the timer then governs operation to completion. Since there are two forming beds with only one being used at a time, certain electrical inter-locks are designed into the circuit. One makes it necessary that one cycle is completed before another can be initiated. The other locks out

the alternate system when one is in operation, so that only one forming bed can be worked at a time. The schematic diagram shown is duplicated for each forming bed.

Applications illustrated here are elementary, but they indicate the great variety of uses for timers in industrial machines. Contacts of the single-interval timers can be arranged in many different ways to open or close in the reset, timing, or timed out phase. In addition, the elements of several single-interval timers can be combined into one multiple-interval timer for control of a sequence of timed periods. For machines which have a timed sequence for starting and stopping and a timed period for running, the multiple-interval and single-interval timers can be used in combination. ▼▼▼

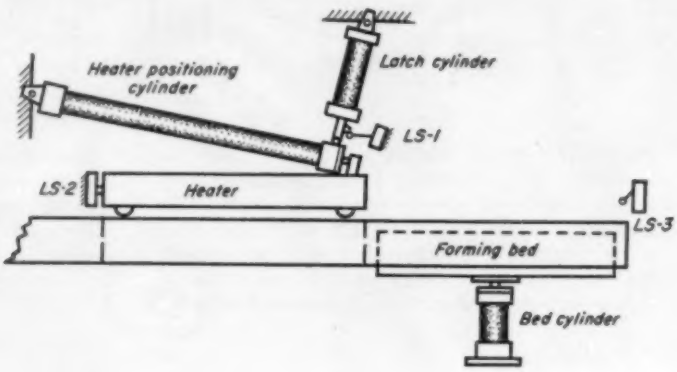
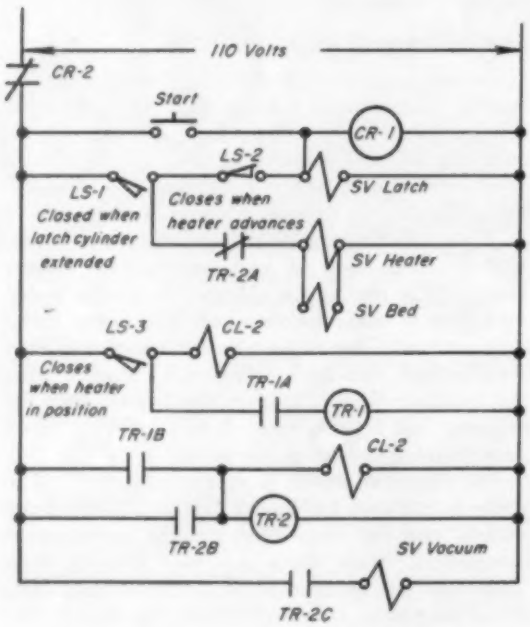


FIG. 8. HEATER of this plastic sheet forming machine is positioned by air cylinders. Dwell time over forming bed is controlled by a timer.

FIG. 9. (BELOW) TIMER CONTROL of embossing press.

1. Operator presses Start switch energizing relay CR-1 and Latch valve. Relay CR-1 has contacts similar to contacts CR-2 but in the alternate circuit.



2. As soon as the Latch cylinder has moved forward and contacts limit switch LS-1, this limit switch closes and energizes both heater and bed valves through timer contact TR-2A. Heater moves forward, bed rises.

3. As soon as heater moves forward, limit switch LS-2 closes. Operator may now remove fiinger from Start Switch.

4. When heater reaches its full operating position, limit switch LS-3 closes, initiating timing cycle of timer TR-1 and the dwell period of the heater.

5. After the preset interval, timer CR-1 times out. Contact TR-1B closes to initiate timer TR-2. Contact TR-2C closes to vacuum valve and contact TR-2A opens. The heater and bed valves are de-energized and heater returns to its center position and bed lowers.

6. As heater moves from limit switch LS-3 limit switch opens and de-energizes timer TR-1 which resets. Timer TR-2 remains in timing position by its own maintaining contact.

7. When heater reaches its neutral position, limit switch LS-2 opens, de-energizing latch valve. In unlatching, limit switch LS-1 opens. The system is now in its starting position, although heater and bed valves cannot be operated until the vacuum preset time interval is completed. When the timer TR-2 times out, the entire system is in its de-energized position and ready for the next cycle. If the alternate system were operated, normally-closed relay contact CR-2 would open preventing the first system from being energized. Since the heater and bed valves cannot be operated while timer TR-2 is operating, this constitutes the electrical interlock required in the control.

Low efficiency and a source of heating which are common to most meter-out circuits can be eliminated by using the circuit shown here. If you select this circuit make sure you don't have to maintain an accurate feed rate for a large negative work load. On this meter-out circuit there is only a small fixed back pressure which is constant for positive loads.

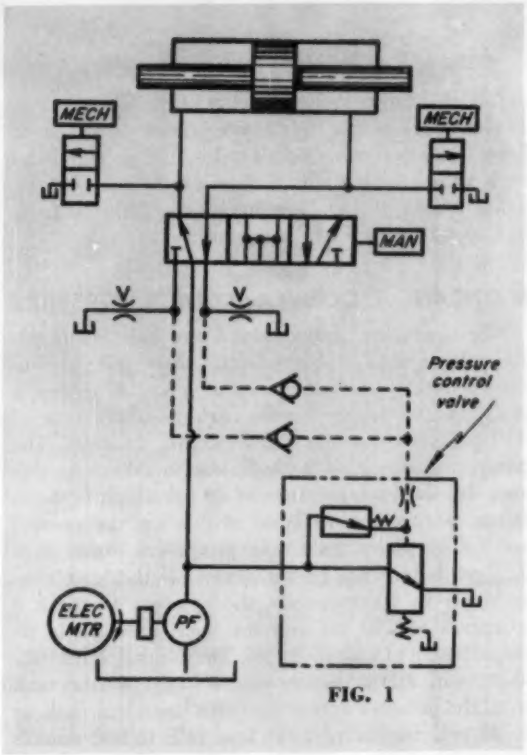


FIG. 1

Pump pressure varies with load on this

METER-OUT CONTROL CIRCUIT

• By J. R. Fawcett

CONTROL of cylinder speed by regulating the flow out of the cylinder is widely used on circuits powered by a fixed displacement pump. With most meter-out circuits you have to accept low efficiency because the pump is always delivering its excess volume back to tank at the maximum setting of the relief valve. Excessive heat in such circuits is not uncommon.

The circuit shown in Figure 1 eliminates this loss of efficiency and source of heat by using automatic pressure regulation. The pump pressure varies to overcome the load plus a fixed back pressure which is determined by the spring of the pressure control valve, Figure 2. The system can be adapted to double or single ended cylinders; a double ended being shown to assist the explanation. The operation of the control depends on the back pressure control valve used in conjunction with two uncompensated variable orifice valves.

The back pressure control valve has a double ended piston which is normally kept closed by the control spring. The lower part of the valve is pressure balanced so that the control spring is opposed only by the control pressure. Until the control pressure builds up to the spring pressure (30 psi) no oil is discharged to tank, but any excess of control pressure opens the valve and oil is discharged to keep the pressure stationary. The jet, or restriction on the control pressure side of the piston, prevents piston flutter and also enables the valve to act as a relief valve. The ball valve opens when the pressure exceeds its spring setting. With the ball valve open pressure builds up on top of the piston, and pushes it down against the control spring to cause delivery to discharge to tank.

In the actual circuit, Figure 1, the back presssure control valve is placed immediately after the pump

and is piped to the pressure port of the 5-port valve. The variable orifice valves are placed in the drain lines from the valve and a pilot line is run from each to the control valve. The non-return (check) valve in each line prevents bypassing of the oil from one metering valve to the other.

MAINTAIN A CONSTANT BACK PRESSURE

The operation of the circuit can best be understood from the simplified circuit, Figure 3. Assuming an effective cylinder area of 5 square inches, a resistance of 1,000 pounds requires a pressure of 200 psi to overcome it, neglecting friction. The pump pressure must be sufficient to overcome this and also the back pressure of 30 psi which is maintained across the variable orifice by the control valve. The pump must then produce a pressure of 230 psi before the piston moves. If the load rises suddenly to 1050 pounds, the pressure to move it increases to 210 psi and the back pressure is reduced momentarily to 20 psi. The control valve then shuts and allows no more oil to go to the tank until the pressure across the valve has again built up to 30 psi. Similarly, if the load falls to 950 pounds the back pressure will rise to 40 psi and open the control valve until the pump pressure falls to 190 psi. The setting of 30 psi will allow a negative load of 150 pounds without overrunning the control but even if this load is exceeded the orifice will act as an uncompensated flow control.

In the complete circuit, each orifice is adjusted independently and only the valve in use is actually in the circuit. As the pump pressure is low, the energy lost in heat is considerably less than with the conventional systems which require the pump

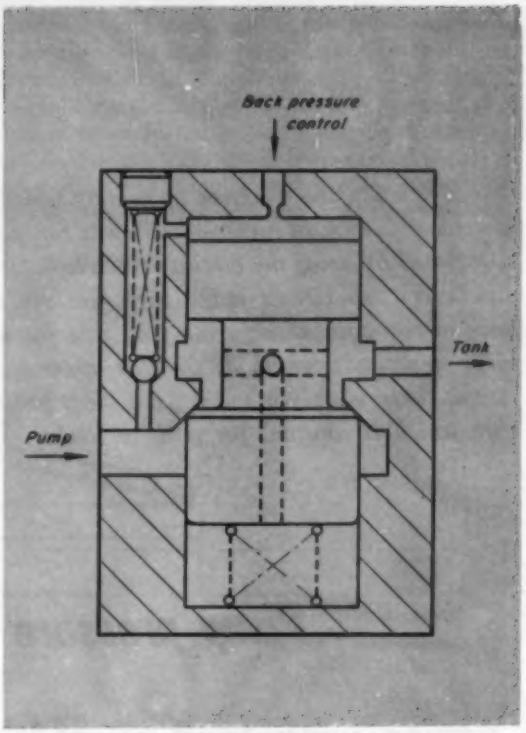


FIG. 2. Pressure control valve provides a fixed back pressure which is determined by the force of the spring below the control piston. A built-in overload relief limits maximum pump pressure.

to discharge through the relief valve at full pressure all the time.

Because of the improved operating characteristics, it is possible, when using this circuit, to select a large delivery pump to meet rapid travel requirements. The mechanically operated shut-off valves shown in Figure 1 cut out the variable flow control when rapid travel is required. ▼▼▼

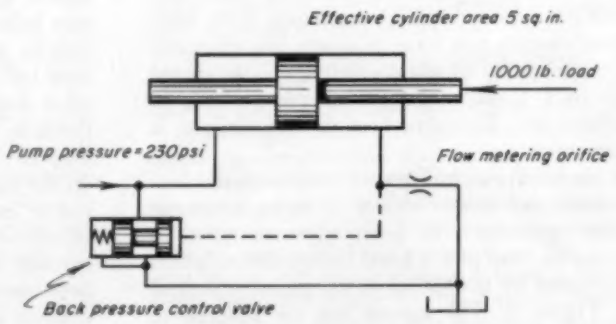
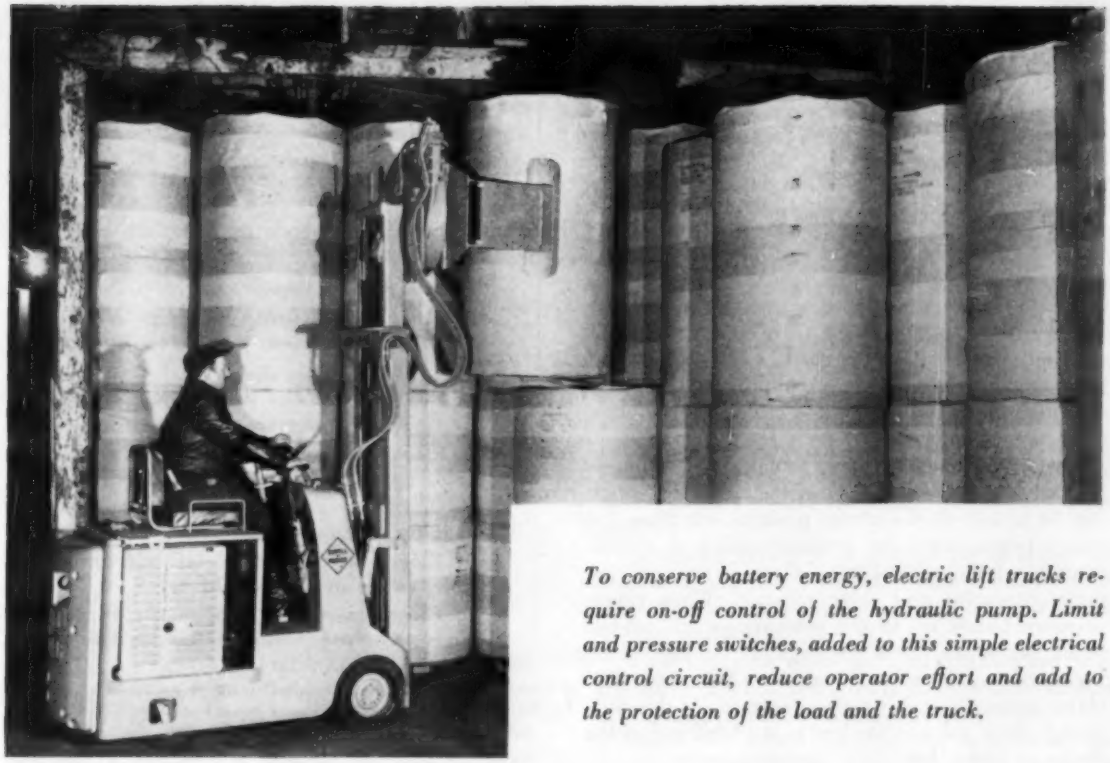


FIG. 3. Back pressure control valve maintains an almost constant pressure drop across the flow metering orifice. As the load changes, the valve repositions itself to maintain the fixed back pressure. In this way, feed rate remains constant regardless of the varying load. Excess pump delivery is bypassed to tank.



To conserve battery energy, electric lift trucks require on-off control of the hydraulic pump. Limit and pressure switches, added to this simple electrical control circuit, reduce operator effort and add to the protection of the load and the truck.

SWITCH AND RELAY SELECTION *for hydraulic lift trucks*

• By Robert G. Vance

CIRCUITS on a battery operated lift truck are simple and include only a few components when compared to, say, a multi-station transfer machine. However, the same, if not more severe, problems of cost, space safety, reliability and simplicity are present.

At the same time that battery power makes necessary intermittent pump operation, it also makes possible electrical safety and actuation devices which are not generally available on combustion engine driven trucks.

The Elwell-Parker F26TRC truck which can handle a 1700 pound load illustrates the selection and design of a control circuit for battery operated trucks. Hydraulically powered operations on this truck include clamping, lifting, tilting, and rotating of the load.

Directional control of the hydraulic cylinders is provided by a ⅜ inch four plunger valve. Each of the four plungers provides three position control—forward, reverse and stop—of the cylinder to which it is piped. In neutral, cylinder ports are blocked and pressure is open to tank. Since plungers are connected in series and the first plunger controls

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the clamp cylinder, clamp pressure has priority over all other functions.

ELECTRICAL COMPONENTS

Pump operation is tied in with the movement of the directional control valve handles. Roller actuated limit switches, are tripped whenever the operator moves his lift, rotate or tilt valve handles. With a rotating attachment on the truck, a normally closed limit switch is put in the circuit to prevent pump operation when the load is too close to the ground to permit safe rotation.

The valve plunger which actuates the clamp is positioned by solenoids. The master switch which can be locked in the clamp position energizes the clamp relay. Since the pressure switch is closed, contacts of the control relay close to energize the pump contactor and valve solenoid. When clamp pressure builds up to the pressure switch cut-out point, the switch opens deenergizing the control relay to release the solenoid and stop the pump. The clamp valve plunger is spring centered. At this time a pilot check valve in the line to the head end of the clamp cylinder holds the clamping pressure.

In the clamp circuit, the pressure switch and the control switch which locks in clamp position prevents the operator from initiating rotation if the load is not firmly clamped. If the work is not fully clamped, the pressure switch will not open, and the clamp valve will be held in the clamp position. Since the clamp plunger is the first plunger in the series connected 4 plunger valve, movement of any other plunger will not result in motion until the clamp plunger is returned to neutral. Therefore, rotation can only take place when there is no load in the clamp or when the load is fully clamped. Selection of the pressure switch is based on the desired clamp pressure and the pressure differential. A Bourdon tube type pressure switch with a 250 psi differential is used in this particular application.

These features influence limit switch selection:

a. Type of actuation such as roller arm, push rod, fork type.

b. Operation—spring return, non-spring return, amount of pretravel, overtravel, and differential.

c. Physical size and installation limitations.

d. Enclosure—environmental conditions.

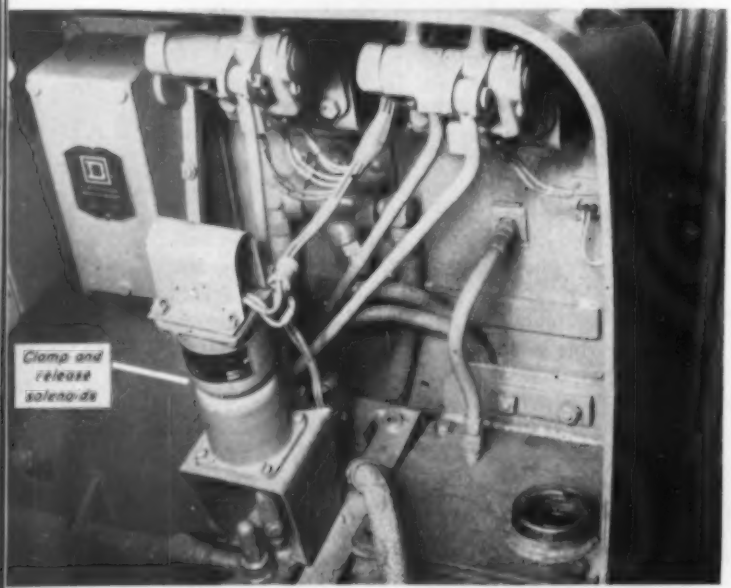
e. Electrical connections—screw terminals, soldier terminals, open or enclosed.

f. Contacts—single or double break, overlapping or non-overlapping.

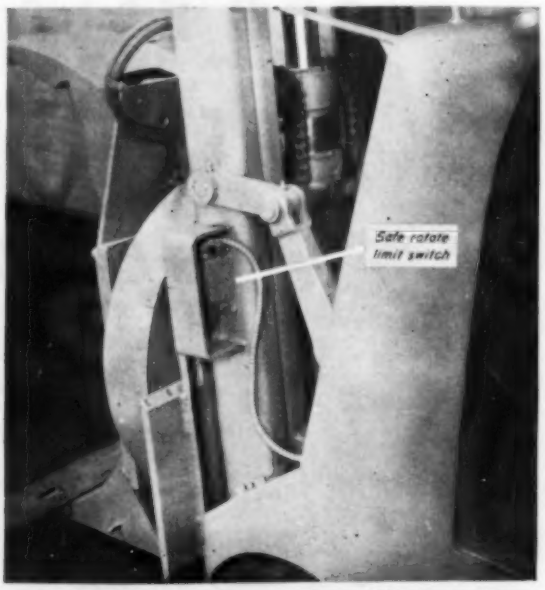
g. Electrical operation—single or double pole, single or double throw.

h. Electrical rating continuous, inrush interrupting capacity—maximum voltage.

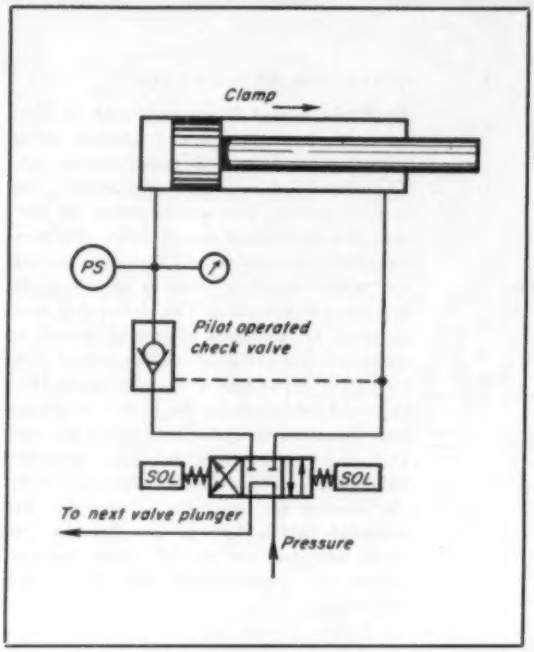
On some lift truck applications, such as the one recently built to clamp a 15,000 pound steel coil, the type of load requires more than one pressure setting. In such cases one, or possibly two, additional pressure switches with a selector switch per-



CLAMP CYLINDER which applies holding force on a paper roll or steel coil is actuated by a solenoid operated plunger in the directional control valve.



LIMIT SWITCH prevents rotation of the load when the lift is too close to the floor. Switch is tripped open to prevent pump operation.



STANDARD FOUR PLUNGER CONTROL valve is modified by fastening a solenoid on the clamp control plunger in place of the manual control linkage. Clamping pressure takes priority over all other hydraulic functions.

mits the operator to set for a high or low clamp pressure.

OTHER SAFETY DEVICES

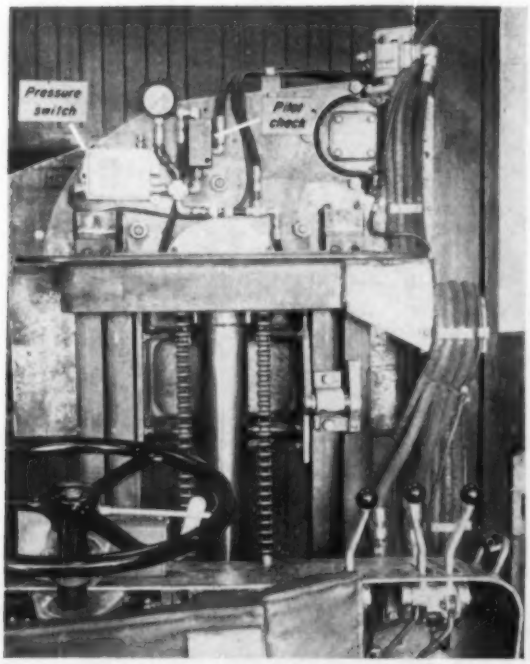
It is a simple matter to add safety and signal devices to the electrical control circuit. A pressure switch in the oil tank may be used to actuate warning devices when the oil level drops to the refill point. When the level is down to ⅓ full, a red indicator light goes on. Ignoring this signal will result in bell ring or pump cut-off when the tank level drops to ¼ full.

To make it impossible for anyone to release a clamped load when the operator is off the truck seat, a normally open limit switch, is in the release valve solenoid circuit. With the safety seat switch open, movement of the release switch will not energize the release valve solenoid. This safety seat switch is only closed when the operator is on the seat.

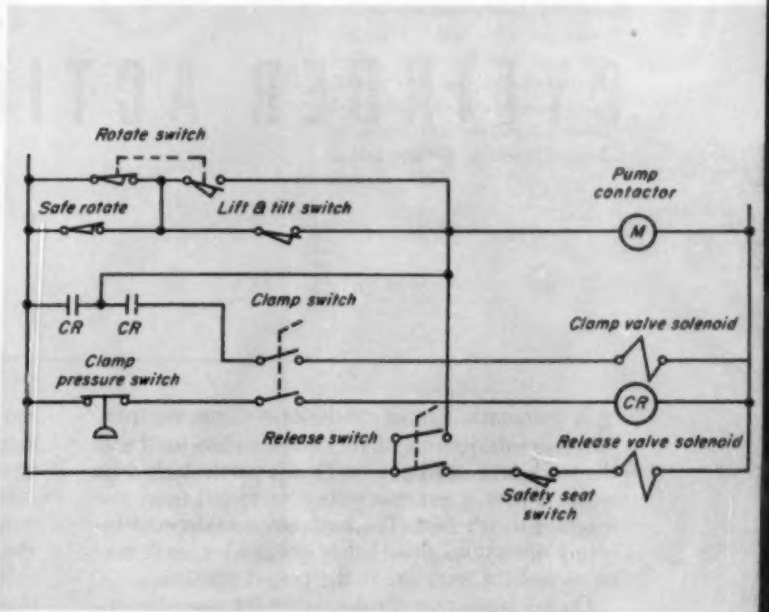
On trucks having hydraulic power steering, operation of the steering wheel which manually positions the steer control valve also trips a limit switch to start the pump.

When the truck wheel position "catches up" with the valve, a pilot rod breaks the contacts to shut off the pump and move the valve to neutral.

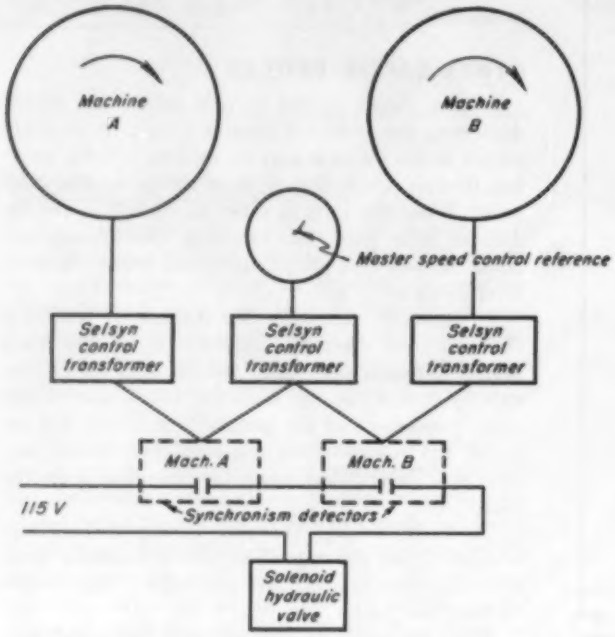
What's the future for electrical controls on hydraulic lift trucks? It depends on the ingenuity of the designer who must make the operation of all attachments safe and convenient. ▼▼▼



PRESSURE SWITCH AND PILOT CHECK VALVE mounted on the elevator frame assure safe clamp operation. The operator can visually check clamping pressure indicated on the dial gauge.



ROLLER TYPE LIMIT SWITCHES are tripped when the operator moves the manually operated valve plungers for lifting, tilting, and rotating. The limit switches energize the pump contactor. Clamp operation is completely controlled electrically. The operator moves the clamp switch to start the pump and shift the clamp control valve.



SYNCHRONISM DETECTOR

Machines A and B are operated as slave units to a master speed control using selsyn generators and transformers and Thymotrol cabinets as the detection and control media. The synchronism detector uses the combined signal from the master selsyn generator and the machine selsyn transformer to determine when the two are synchronized. The detector is used to close an external electrical circuit to energize the solenoid valves, when synchronism is within a certain limit. The solenoid valves are in the hydraulic clamp and transfer circuits. Connecting the output of two detectors in series requires that both machines be synchronized with the master set in order to energize the solenoid valves. Contacts in the synchronism detector are closed when the machines are synchronized with the master reference.

How to Key CYLINDER ACTION to Machine Speed

• By C. R. Meckstroth

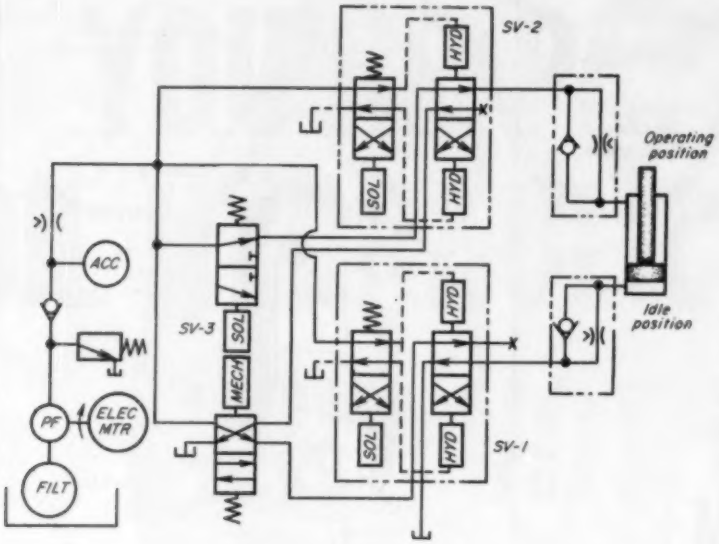
AN automatic line of machines without any protective devices might very quickly chop itself and the work into small pieces. This is particularly true where a part is automatically transferred from one machine to the next. The unclamp, transfer and reclamp operations should only occur when each machine and the work are in the proper position.

On machines recently developed for assembly operations by General Electric engineers, the sequencing control is quite unique. The basic timing problem confronting GE's designers is similar to those in many other industries where the work is transferred between rotating machines.

Here is how this control-system works for two separate machines, each rotated by a separate drive, and one transferring parts into the other. Both machines must be synchronized with a speed reference if parts are to be properly transferred.

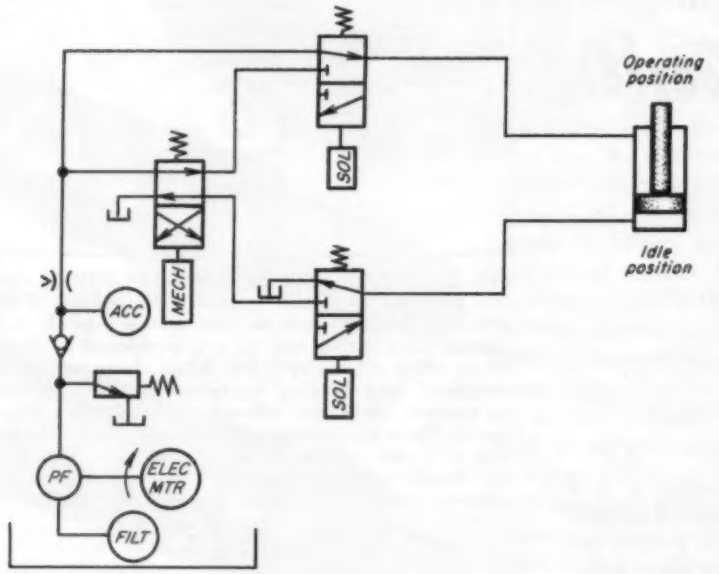
On these machines, actual operation of the clamp and transfer cylinders is controlled by a cam operated 4-way two position valve. This valve is tripped by cams on the main drive shaft which powers the rotation of the machine. This system positively ties-in the operation of the clamp and transfer cylinders

C. R. MECKSTROTH, Design Engineer, General Electric Co., Cleveland, Ohio.



TRANSFER CIRCUIT

While machines are synchronized, all solenoids are energized by a synchronism detector, and control of the cylinder is by the cam operated 4-way valve. When the machines are not synchronized all solenoid valves are deenergized so that the blank end of the cylinder is connected to tank through SV-1. The rod end is connected to pressure through SV-3 and SV-2. Operation of the cam operated valve does not affect the circuit.



CLAMP CIRCUIT

Solenoid valves are connected through relays to the synchronism detector so they are energized when the machines are synchronized. When the valves are energized, all control is by the cam operated 4-way valve. When the machines are not synchronized, the solenoids are deenergized to cause the piston to move to and remain in the idle position.

with rotation of the machine.

A simple cam operated valve directing oil to the double acting cylinder would be adequate—if both rotating machines are perfectly synchronized. When and if either of the machines gets out of step or if they are out of step when the cycle is first started, there is need for some means of preventing cylinder operation even if the cam operated valve is tripped.

Addition of solenoid operated valves in the lines to the rod and blank ends of the cylinders is made to provide this protection. When the machines are synchronized, the solenoid valves are held energized and operation is controlled by the cam valve. Should the machines get out of step, the solenoid valves are deenergized to cause oil pressure to move and hold the actuating cylinders in the idle position regardless of the operation of the cam valve.

To energize and deenergize the solenoid valves, a synchronization detector is required. This may take many forms. In the G. E. design, speed of the working machines is monitored by a motor rotating at a fixed speed. The electrical circuit is established so that any deviation of machine speed from the standard causes the solenoid valves in the cylinder control circuit to be deenergized.

Protection of the machine and the work is the only function of the solenoid valves in these circuits.

▼▼▼

This servo system was designed for the speed control of an automobile, but the application of a cylinder to control the position of the accelerator cable suggests many other uses.

SERVO SYSTEM

... for speed control

• By Charles M. George

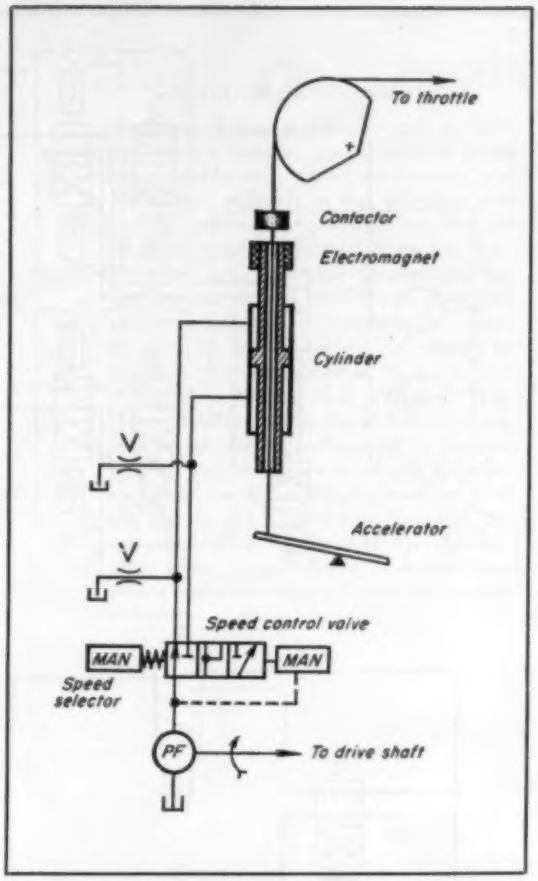


FIG. 1. DRIVER SETS SPEED SELECTOR to control pressure on speed control valve spring. Pilot pressure proportional to automobile speed acts against valve spring and valve is positioned to direct oil to either side of cylinder. When electromagnet is energized and holding contactor, cylinder adjusts accelerator cable and throttle to maintain preset speed. When electromagnet is not energized, cylinder acts as a stop to limit travel of contactor. This stop can be overcome by applying extra pressure to accelerator pedal to overcome pressure in cylinder.

AN ingenious application of hydraulics is in a device developed for the speed control of an automobile. Using a hydraulic cylinder to position the accelerator cable, the speed controller either maintains a constant preset speed or limits the maximum speed to any preset value. The cable running through the cylinder piston rod is engaged by the electromagnet mounted on the piston (see Figure 1).

A gear pump driven by a dual speedometer takeoff on the drive shaft rotates at a speed proportional to the speed of the car regardless of the transmission used. The needle-type flow control valves are adjusted to bypass all oil up to the volume delivered by the pump when the automobile is traveling at 15 mph. At greater speeds with greater volumes of oil being pumped, a back pressure proportional to the speed is developed. This pressure is applied to pilot the speed control valve. This pilot pressure is opposed by spring pressure which is controlled by the speed selector. An unbalance between these two pressures, positions the valve to direct oil to one of the cylinder ports. When the electromagnet is energized and holding the contactor, the cylinder positions the throttle to control the speed of the automobile.

CONSTANT SPEED OPERATION

For example, assume that the driver is traveling at 30 mph and wishes to accelerate and automatically maintain a speed of 50 mph. He closes the master switch and presses the start switch to energize relay 1CR, see Figure 2. Contacts of relay 1CR close to lock in the relay and to energize the electromagnet M. The lamp in parallel indicates that the electromagnet is energized. The speed selector is then rotated to the 50 mph setting loading the speed control valve spring. Since the pilot pressure applied

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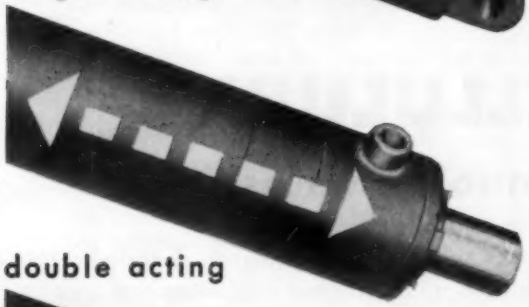

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to the speed control valve at 30 mph is less than this spring pressure for 50 mph, the valve moves to direct oil to the upper port of the cylinder. The lower port line is closed by the speed control valve and the trapped oil drains off through the flow control valve as the piston moves. Momentarily pressing the accelerator pedal brings the contactor into contact with the electromagnet which holds it. This connects the accelerator cable to the cylinder. The throttle is advanced, accelerating the automobile and increasing the pump speed until the pilot pressure on the speed control valve balances the preset spring pressure.

Any increase or decrease in speed of the automobile changes the pump speed and the pilot pressure on the valve. The resulting unbalance causes corrective action on the cylinder to adjust the throttle accordingly. When the speed control valve is in neutral, sufficient oil enters both cylinder lines to maintain pressure on both sides of the piston. Oil circulating through the flow control valves to the reservoir prevents excessive heat and pressure from developing, even at maximum pump speed.

To disconnect the automatic speed control, either the stop switch is momentarily actuated, or the driver applies the brakes closing the pressure-actuated brake switch. This is the same switch that energizes the stop lights. Actuating the switch energizes relay 2CR, and contacts 2CR open to de-energize relay 1CR and the electromagnet M.

SPEED LIMITING

The operation for speed limiting is similar to that for maintaining a preset speed, except that the start switch is not actuated and the electromagnet is not energized. The speed selector is turned to the desired maximum speed. At any speed below this maximum value the contactor will not come into contact with the piston rod, and this permits free movement of the accelerator pedal. Full throttle acceleration for changing gears (either automatic or manual transmission) will not be affected. However, as the preset speed is reached, the piston rod will block the contactor and accelerator cable unless sufficient force is applied to the accelerator pedal to overcome the hydraulic pressure in the cylinder. This force is such that the driver can apply it for a short time during an emergency, but would find it uncomfortable for any extended period. The accelerator pedal continues to push back on the driver's foot until the automobile returns to the preset speed. On stopping the vehicle, the piston retracts completely to allow as much throttle travel as necessary for starting. All effects of the equipment are eliminated by rotating the speed selector to its highest speed position.

Tests reveal that the response time depends upon the amount of oil bypassed through the flow control valves. The optimum setting is for zero pressure at speeds up to 15 or 18 mph. Constant speed—within power limitations of the automobile—are maintained within 2 mph. The force required on the accelerator pedal to override the preset speed limit during an emergency varies somewhat with car speed. The force at 30 mph is about 10 lb, and at 60 mph it is 25 lb. Full throttle acceleration from a slow speed to a high speed is not affected until the car approaches the preset speed limit. At that time the piston firmly pushes back on the accelerator pedal until the equilibrium speed is reached.

COMPONENT DESIGN

All hydraulic components are combined into two assemblies installed in the engine compartment of the automobile. The power unit consisting of reservoir, pump, pump drive, speed control valve, and flow control valves is mounted in any convenient place which permits connecting the flexible-shaft pump drive to a dual speedometer take-off on the drive shaft. The cylinder and electromagnet assembly is mounted on the existing accelerator cable or on a cable extension. The accelerator cable runs through the shaft and the electromagnet is mounted concentrically on the upper shaft end. The contactor for the electromagnet is mounted on the accelerator cable. Electrical control components and the speed selector are mounted on the instrument panel. The speed control dial is connected to the spring adjusting screw of the speed control valve by flexible shafting or universal joints. Copper tubing with commercial fittings is used for oil lines.

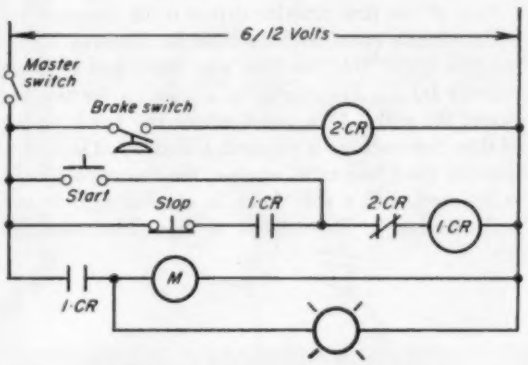


FIG. 2. CLOSING MASTER SWITCH and pressing start switch energizes relay 1CR and electromagnet. Light indicates electromagnet is energized. Pressing stop switch, applying brakes, or opening master switch de-energizes electromagnet. Pressure-actuated brake switch energizes relay 2CR which de-energizes relay 1CR and the electromagnet.

Design of this speed control is based on two principles common to practically all modern cars: (1) a standardized speedometer drive ratio of 1000 rpm of the take-off shaft at a vehicle speed of 60 mph, and (2) the almost universal practice of actuating the throttle valve linkage of the carburetor by a cable and pulley segment.

▼▼▼

HYDRAULIC CRAWLER DRIVE

. . . new development for mobile equipment

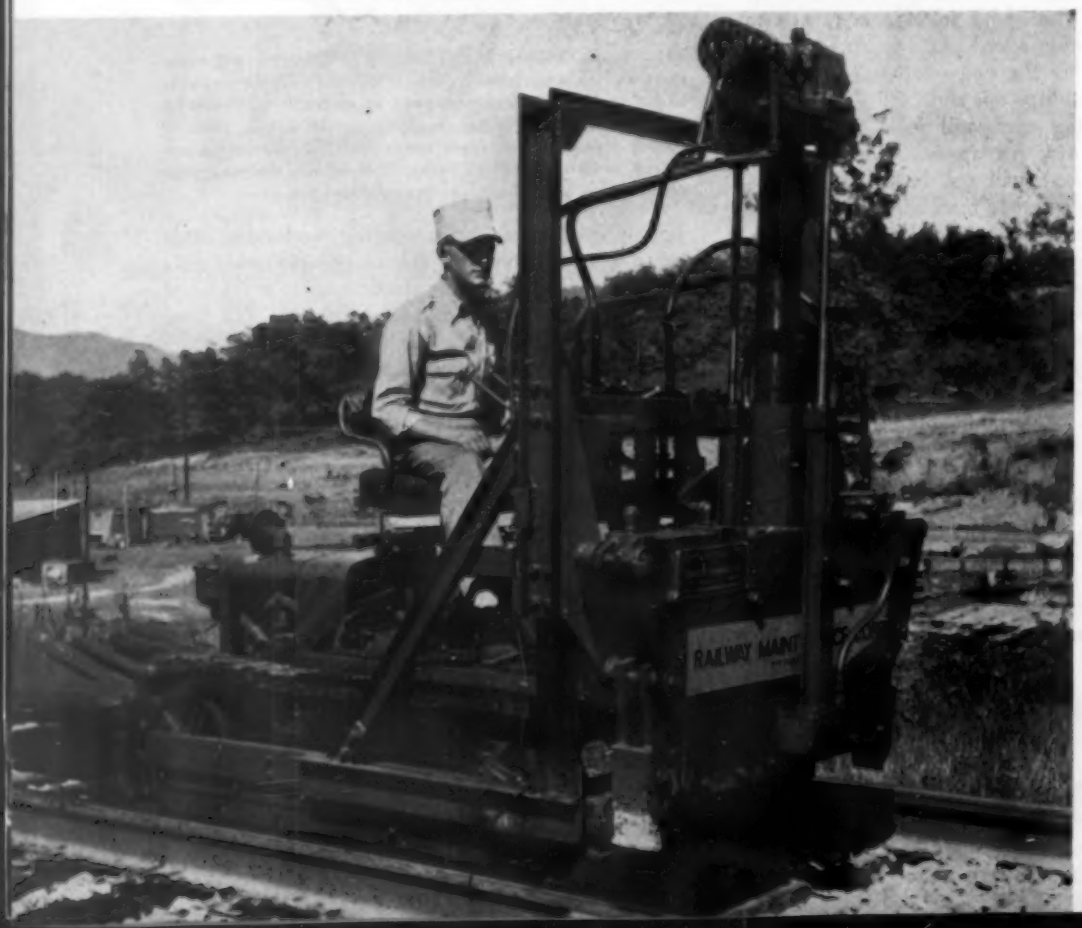
TORQUE output and speed control are the two things that the designer of a crawler drive must provide. Developing a hydraulic drive to provide the necessary torque and speed can offer advantages of reduced space and reduced cost. Several manufacturers of crawler driven machines have eliminated mechanical clutching and drive systems by using a positive displacement pump and motor drive with gear reducing units when needed.

One of the first crawler drives to be powered by hydraulics is on a machine built by Railway Maintenance Corp. This machine was developed to align railway tracks. The tractor is driven on the ties between the rails. At a point where the track is out of line, the machine is stopped, a shaft spud is driven into the road bed as an anchor, the lining tool head is lowered, and a side force is exerted against the rail to align it. The anchor is then lifted and the crawler moves on to the next point covering more than 6000 feet per day. Two men are now able to do the work that once required 12 to 16 men.

Because a force of 12½ tons to move the rails can best be developed hydraulically, it was decided that hydraulics should power all functions of the machine. This choice also provided the compactness that was required for the machine to be driven between the rails, and the simplicity for it to be operated and maintained by the average railroad worker.

2000 PSI PUMPS ARE USED

Hydraulic pressure is developed by two pumps driven at 1470 rpm by a 12-hp, 2-cylinder gasoline engine. Each pump delivers 5½ gpm at 2000 psi. The pumps, the anchor drive motor, and the crawler



THE DRIVE AND ALL functions of the rail aligning machine are powered hydraulically. Eight valves mounted in front of the operator provide control.

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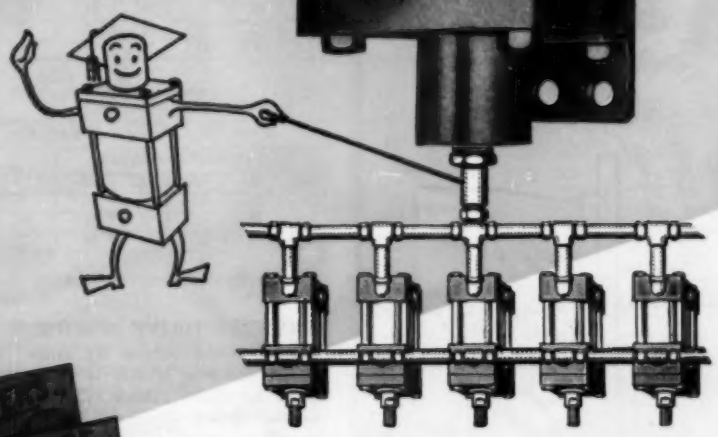

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drive motors are all identical, vane-type motor-pumps. These units are designed so that they can be used interchangeably as pumps or motors. This has the advantage of simplifying the stocking of replacement parts. 4-plunger valves control the hydraulically powered functions except lifting the machine for removal from the tracks. Feathering of the valve spools permits fine control.

The rail aligning machine is driven by two hydraulic motors each driving one of the tracks through a cone drive reduction gear. The cone drive was selected after it was found to give more horsepower in a smaller space than other types. Originally a direct drive with the hydraulic motor connected to the drive sprocket of the track was considered. However this required a larger size motor to obtain the same torque, and this idea was eliminated because of space and cost considerations. The cone drive reducers can be equipped with various gear ratios making them readily adjustable for speed and torque outputs to meet any special requirement.

SEPARATE PUMP FOR EACH CRAWLER

Assuming 80% system efficiency at 1130 rpm each motor has an output of approximately 5 hp. This means that the crawler drive motors deliver about 10 hp to put the machine into motion. More than enough power is available to move the machine along between work stops at a speed of 3 mph. Each crawler motor is controlled by a separate valve and takes oil from a separate pump.

The lining head is raised and lowered by a hydraulic cylinder which exerts a force of 3 tons at

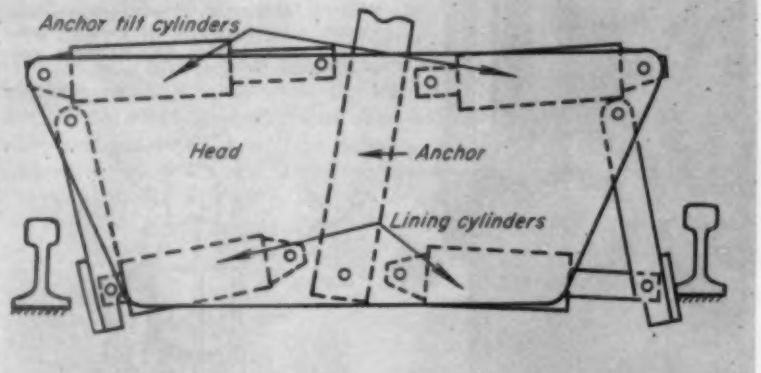
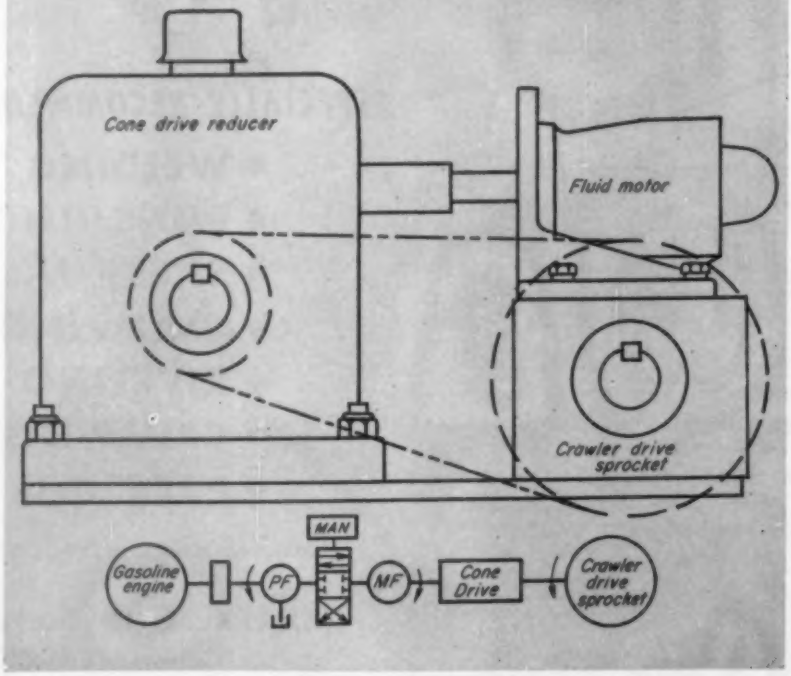


DIAGRAM SHOWING lining cylinder exerting force against right rail. Anchor has been tilted by tilt cylinder for better support. Side travel can be controlled from 1/16 to 6 inches.



CRAWLER DRIVE SPROCKET is chain driven by cone drive reducer which is powered by fluid motor. Circuit shows drive sequence from gasoline engine to crawler drive sprocket.

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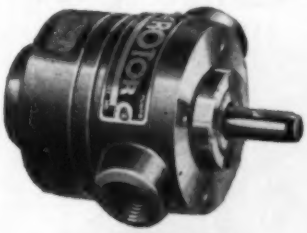
The GEROTOR line of precision engineered hydraulic pumps is designed to fill the requirements of the majority of hydraulic equipment users. The three standard GEROTOR models cover a range of g.p.m. delivery from .4 g.p.m. to 40 g.p.m. Check the selection data for the pump to fill your needs.



TYPE QDB

Gerotor's NEW QDB series of small capacity pumps . . . the last word in precision engineering.

DELIVERY G.P.M. — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.42	.40	.38	.35	.31
QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

Selection Data

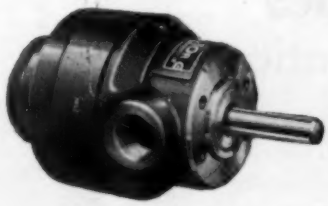
HORSEPOWER REQUIRED — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.08	.16	.24	.33	.41
QDB .75	.13	.27	.41	.56	.71
QDB 1.5	.16	.42	.70	1.00	1.28

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i.

SPEED—Standard design speed is 1800 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE QDH

The QDH . . . popular intermediate size of the Gerotor line

DELIVERY — G.P.M. AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	3.3	3.2	3.1	3.0	2.9	2.7	2.5
QDH 5	5.6	5.4	5.3	5.2	5.1	4.8	4.4
QDH 8	8.6	8.5	8.4	8.3	8.2	8.1	7.8
QDH 12	12.9	12.8	12.7	12.5	12.3	12.2	11.8

Selection Data

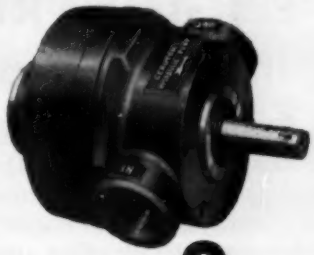
HORSEPOWER REQUIRED AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	.25	.7	1.2	1.6	2.1	2.5	3.4
QDH 5	.33	1.1	1.8	2.5	3.2	3.7	4.6
QDH 8	.4	1.5	2.7	4.2	5.4	6.3	7.9
QDH 12	.5	2.3	4.2	6.1	8.0	9.6	11.7

PRESSURE—Maximum continuous operating pressure is 1200 p.s.i., maximum intermittent 1500 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is also available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE O

Gerotor Series O . . . when larger capacities are needed

DELIVERY — G.P.M. AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	20.0	19.5	18.8	18.0	17.2
O-25	25.0	24.5	24.0	23.2	22.2
O-30	31.2	31.0	30.5	29.8	29.0
O-40	43.0	42.5	42.0	41.5	40.0

Selection Data

HORSEPOWER REQUIRED AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	1.0	4.0	7.2	10.5	13.5
O-25	1.5	5.0	8.6	12.0	15.6
O-30	2.0	6.5	10.9	15.5	19.5
O-40	3.0	9.0	15.0	21.0	27.5

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i., except type O-40, which is recommended for only intermittent duty at 1000 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

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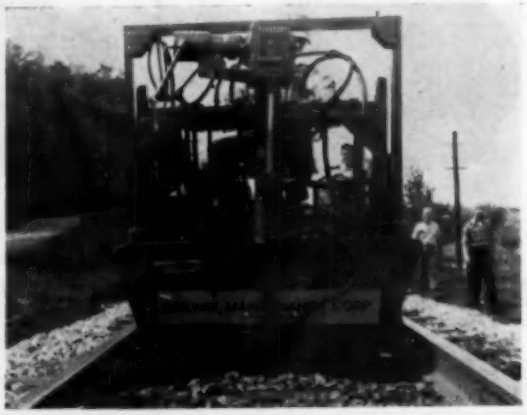
2000 psi and has a travel of 19 inches. The head is guided by rollers which ride in a channel on the main frame. The rotating anchor shaft is mounted on the head and is driven down between the ties by the anchor motor and is firmly seated in the road bed. The anchor shaft is lifted by two cylinders having a travel of 25 inches. The cylinders operate together to exert a total force of 1.8 tons at 2000 psi.

The lining cylinders which move the rails are attached to the lining head. These lining cylinders exert 12½ tons force at 2000 psi against either rail and can move the rails from 1/16 to 6 inches in either direction. Side movement is under precise



VIEW SHOWING lining tool head lowered and anchored. Lining shoe is exerting force against rail on right. Anchor drive motor and gear box are mounted over anchor.

control of the operator who has a valve for each lining cylinder.

To provide better anchorage, a hydraulic cylinder is mounted on each side of the pivoted anchor to tilt the anchor. When the lining cylinder has engaged the rail, these tilt cylinders may be used for additional lining movement. The tilt cylinders exert a force of 12½ tons each at 2000 psi and have a travel of 8 inches.

A hydraulic cylinder is mounted vertically at the exact center of gravity to lift the crawler out of the tracks. Operating auxiliary globe valves in conjunction with the main control valves extends the cylinder, lifting the crawler for removal from the tracks. The cylinder exerts 5 tons force at 2000 psi and has a travel of 15 inches.

The tractor crawler is in service on a number of railroads and has been operated long enough to prove its superiority. The use of hydraulics on this machine suggests similar applications on crawler tractors used in mining, farming, and road building.

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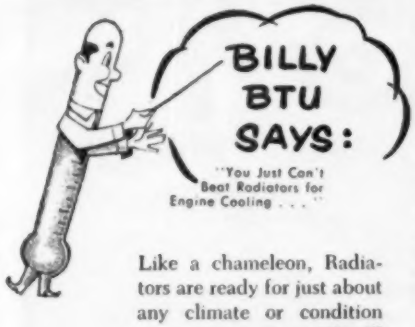
Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

Drill Rig Engine Overheating Relieved With Young Torque Converter Coolers



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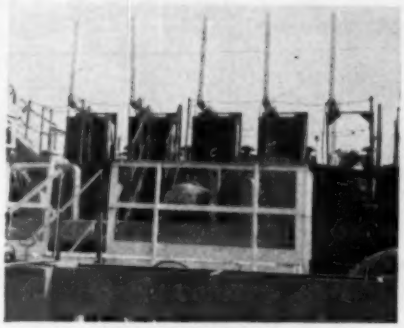
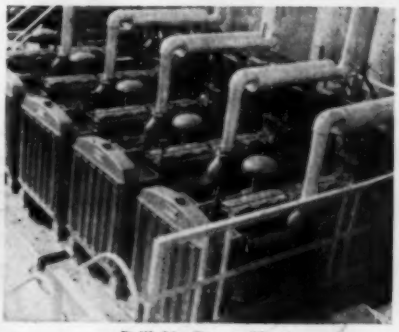
Don't be fooled by the claims of other types of engine cooling systems. Remember, only Radiators can provide efficient engine cooling under every type of climate or condition.



Young Torque Converter Coolers being installed



Drill Rig Power Plant

COMPLETE RADIATOR, FAN AND DRIVE UNITS FURNISHED BY YOUNG

To prevent overheating of engines furnished on the drilling rig built by the National Supply Company, Torrance, California, five Young Radiator Company Model OCS-450 Torque Converter Coolers were specified.

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Since engines and rigs were built for export, the Young Torque Converter Coolers were selected to secure brazed construction and also to obtain a complete Radiator, fan and drive unit. On the subject drilling rig, the Young Units were added for this purpose. They did not, however, replace any type of radiator.

Front view Young Model 450 Torque Converter Cooler

For more details about Young Torque Converter Coolers, write for free Young Catalog No. 1054 described at left.

WRITE FOR FREE YOUNG RADIATOR COMPANY TORQUE CONVERTER COOLER CATALOG

Completely describes the entire line of Young oil to water and oil to air, Torque Converter Coolers. Illustrates features, cores, mobile and stationary types; dimension drawings, tables and performance charts. Handy sales and engineering office listing provided on page eight for your convenience. Write for Catalog No. 1054, to: Young Radiator Company, Dept. 445-F, Racine, Wisconsin.

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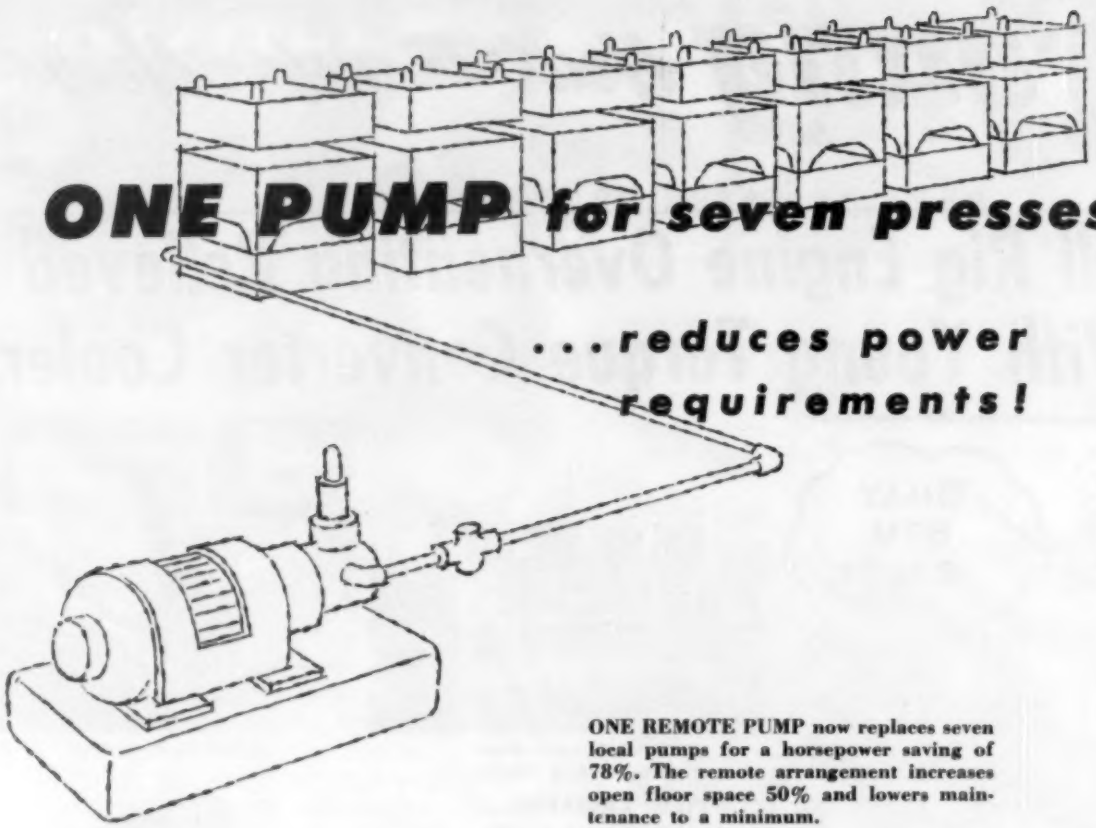

ONE REMOTE PUMP now replaces seven local pumps for a horsepower saving of 78%. The remote arrangement increases open floor space 50% and lowers maintenance to a minimum.

• By Robert A. Bullard

MOST manufacturers rate floor space and horsepower consumption high on the list of the overhead which must be added to the total cost of the product. Increased usage of floor space and reduction of horsepower consumption adds to his competitive position. The Geo. H. Bullard Co. was able to increase their floor space usage 50%, reduce their horsepower consumption 78%, and yet increase production 10% by consolidating their hydraulic system.

This abrasive products manufacturing concern operates a battery of seven hydraulic presses. Formerly these had individual hydraulic reservoirs, pumps, and regulating valves located beside each press. This produced cramped and dirty surroundings, created maintenance problems, and was inefficient. A total of 45 hp was required to operate the pumps which were conventional hi-lo pressure pumps. The low-pressure, high-volume pump supplied fast travel to the press ram, and cut out when the ram bottomed. The high-pressure, low-volume pump then supplied pressure for the required squeeze. Because these pumps were operating in the manufacturing area, they were constantly subjected to abrasive dust and maintenance costs were high. Despite every attempt to protect against the dust, unavoidable wear and noise resulted.

A relocation of the presses, and the need for additional space prompted an investigation of a system which would be less complicated, more compact, and efficient, and above all isolated from the manu-

ROBERT A. BULLARD, *Geo. H. Bullard Co., Inc., Westboro, Mass.*

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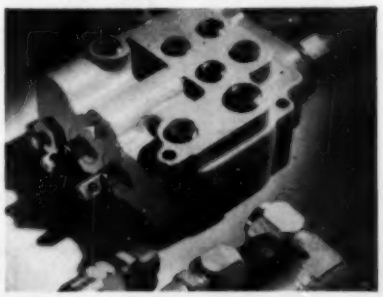

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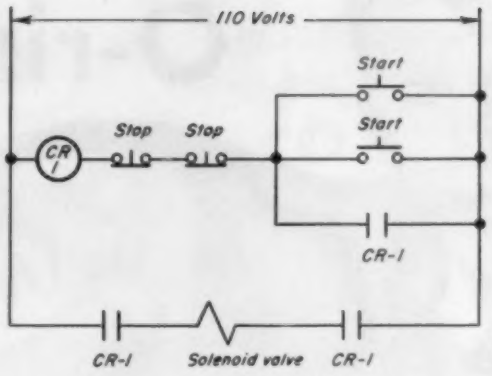
ONE PUMP FOR SEVEN PRESSES

facturing area. Although the present system is relatively simple, it conforms with all these conditions.

In the present design, either of two hydraulic pumps supplies all seven presses. The pumps are located away from the abrasive atmosphere of the manufacturing area and each press has its own valves, booster, and electrical control. Any future presses can be added on in parallel with the present presses.

The variable-volume, pressure-compensated pumps deliver only the oil required for operation of the circuit. Previously relief valves were used on each pump to regulate the pressure within ±2 psi. With the present pumps, relief valves are not needed because the pump delivery decreases as the pressure increases. This eliminates wasteful by-passing of unneeded oil reducing horsepower consumption and oil heating, and increasing efficiency. In addition these pumps permit fast press closing and high-pressure squeezing.

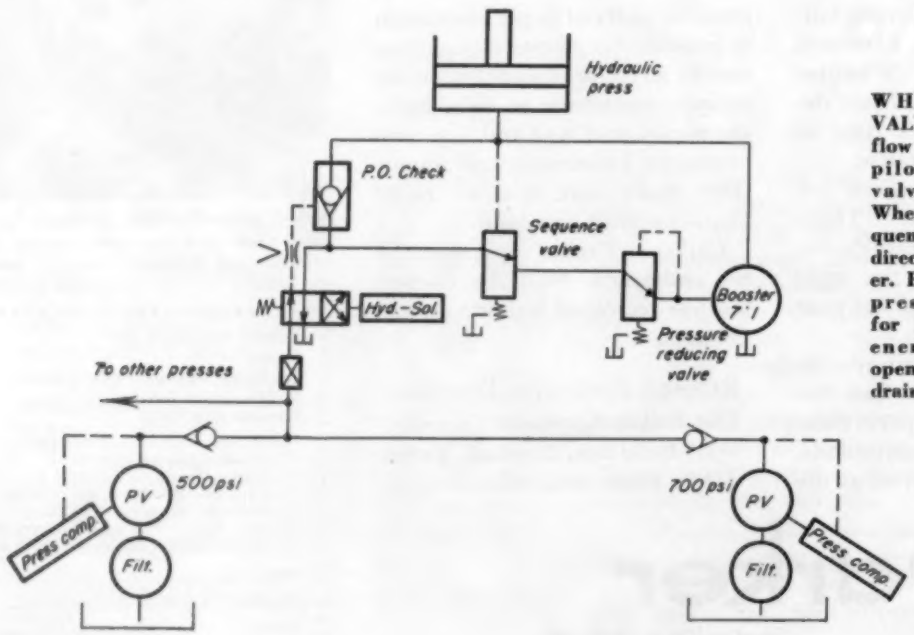
The two pumps draw from separate reservoirs and are connected to a common high-pressure line through check valves. This permits operating each pump independently, with one pump installed as a standby in case of emergency. A line pressure of 700 psi is the maximum requirement and in most cases 500 psi is sufficient. One pump is set for the higher pressure and the other is set for the lower pressure. Operating mostly on the lower pressure pump tends to keep the oil temperature down, reduces the strain on the pump, and gives 3500 psi ram pressure with the booster. When the higher pressure is needed, the pump set for 700 psi gives a booster pressure of 4900 psi.



TWO PUSHBUTTON STATIONS with "Start" and "Stop" pushbuttons are mounted on each press. The relay actuates the solenoid valve to control flow to the check valve and sequence valve.

Each press is connected to the high pressure line through a globe valve, so that any one or combination of presses can be operated. The four-way, solenoid-controlled, pilot-operated valve controls flow to the pilot-operated check valve and to the sequence valve. When the solenoid is energized by one of the "Start" pushbutton switches, the valve directs flow through the pilot-operated check valve to raise the press ram. When the ram bottoms, the pressure builds up to the sequence valve setting. This actuates the sequence valve which directs flow through the pressure reducing valve to the booster. The pressure reducing valve regulates the booster

Continued on page 72



WHEN SOLENOID VALVE is energized, flow is directed through pilot-operated check valve to raise ram. When ram bottoms, sequence valve is actuated directing flow to booster. Booster multiplies pressure seven times for ram squeeze. De-energizing solenoid opens check valve and drains ram pressure.

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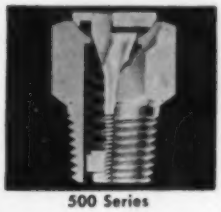

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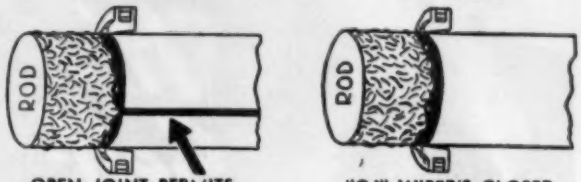

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CENTURY PRODUCTS, Inc.
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ONE PUMP FOR SEVEN PRESSES

Continued from page 70

input pressure and consequently the final ram pressure. It provides a covenient pressure control for the operator.

The booster is an automatically reciprocating piston with large areas exposed to the line pressure and small area pistons at each end to force the oil out at high pressure. The booster provides a pressure increase of 7 to 1. The volume delivered is inversely proportional in this same ratio. As an example, if 30 gpm is entering the booster at 700 psi, the output will be 4.2 gpm at 4900 psi.

At the high pressure, the pilot operated check valve closes to prevent flow from the ram. Pushing one of the "Stop" pushbutton switches de-energizes the solenoid valve applying pump pressure to the pilot line of the check valve. This opens the check valve and drains the line from the ram allowing the ram to descend. It was found that releasing the high pressure from the ram resulted in a surge which caused leakage. A restriction valve placed in the pilot line to the check valve slows the action of the valve sufficiently to release the pressure smoothly.

INSTALLATION OF COMPONENTS

A "Start" and "Stop" pushbutton switch is mounted on two sides of each press. These control a relay which actuates the solenoid valve. Contacts lock-in the relay through the two "Stop" switches.

The 30-gpm, 1000-psi pumps are installed on two 70-gal reservoirs in a room closed off from the rest of the plant. Rubber mounts under the pump motors and a short length of high pressure hose in the line eliminate most of the pump noise. Each pump is driven by a 10-hp motor, and since only one pump is operated at a time, the horsepower is reduced from 45 to 10, or 78%. A 1¼-inch line runs from the pump room across the full length of the press room. A globe valve is installed at the end of this line and is connected directly to a 1½-inch return line which follows the pressure line back to the reservoirs. The return line is openly connected to both reservoirs to circulate oil from both tanks. In this manner a constantly maintained line pressure is delivered to each press. High pressure piping has been reduced by eliminating extra heavy pipe and fittings except for the line from the booster to the ram. The problem of leakage is also minimized, allowing suspension of all valves overhead leaving the working area around the press clear. All piping and electrical circuits are color coded for quick identification and simplified maintenance.

The system has been in use for over a year and it is estimated that production has increased approximately 10% because of the neater work areas and the decreased operator strain with the reduction of noise. ▼▼▼

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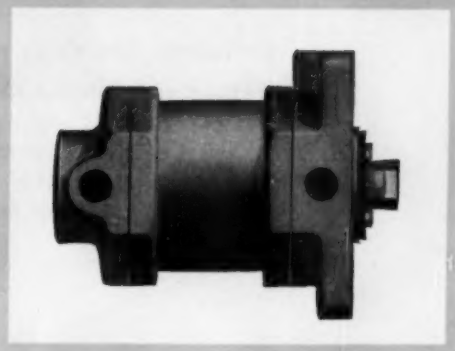

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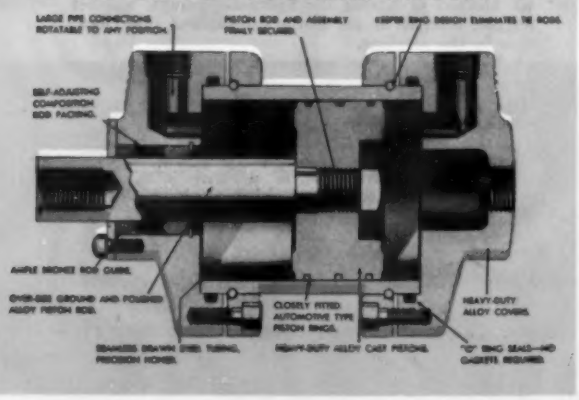
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HOW TO REDUCE WEIGHT

of aircraft hydraulic systems

Part 1 By Circuit Design

• By K. G. Hancock

MODERN heavy airplanes use a large amount of hydraulic power for operating various auxiliary services. On a 100,000 lb military airplane using a hydraulic system capable of supplying possibly 30 hp for actuation of undercarriage, flaps, bomb doors, air brakes, nose steering etc., the weight of hydraulic components and pipes is approximately 1000 lb. As this figure might be between 5% and 10% of the payload, it is clear that weight saving of hydraulic installations is of importance.

The investigation of weight saving falls conveniently into two parts. First the saving in pipe weight and reduction of the number of hydraulic components used, which is influenced by good circuit design; and second, the saving in the weight of components which is dependent on the detail design of the components themselves and the mechanisms they operate.

CIRCUIT DESIGN

There is no doubt that collecting sufficient data so that the merits of various circuits can be compared for one particular installation is difficult, and very often laborious. The principle difficulty is that it is usually impossible to generalize and, consequently, the circuits under consideration must be expressed in terms which can be compared. This can conveniently be done by designing each alternative circuit so that its output hydraulic horsepower is the same and meets the circuit requirements, and then comparing the weight of all the pipes and components involved.

The factors influencing the weight of a hydraulic circuit are:

a) Maxium power requirements, and the amount of power to be supplied by the pumps.
b) Method of driving the hydraulic pumps, whether engine, electric or air motor driven, and their location in the airplane.
c) Location of the service demanding maximum hydraulic power.
d) Emergency requirements of the various circuits.
e) Operating pressures.
f) Control of hydraulic power.
g) Operating temperatures.

a) Maximum Power Requirements

Knowing the maximum power requirements of each circuit, it must be decided whether the majority of this is to be supplied by accumulators or pumps. This is governed partly by the duty cycle

K. G. HANCOCK, Chief Hydraulic Designer, Electro-Hydraulics Limited, Warrington, England.

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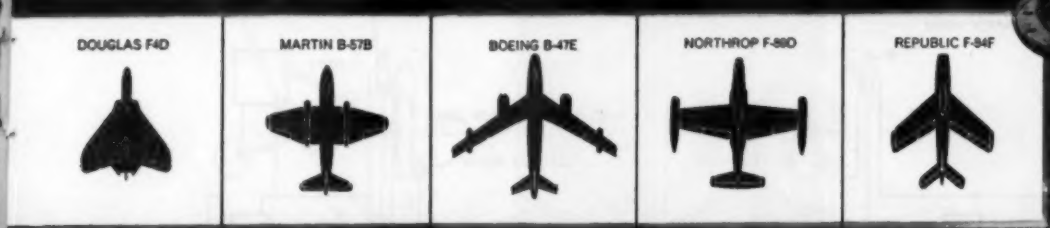
THE HIGH ARE THE MIGHTY



LEAR

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for the service and partly by the horsepower required, the large power, short time duty cycle favoring the accumulator with a small pump to charge the accumulator for the next cycle. In considering the question, it is necessary to take the optimum ratio of accumulator pressure to jack pressure so that the accumulator system can be shown in its most favorable form for comparison with a pump system. This is usually found to be between 1.5 and 2.0.

Taking a reasonable compression ratio for the accumulator circuit the merits of pump or accumulator systems can be considered. If it is not obvious by inspection which is the better—for example, a nose flap actuator requiring say 100 hp for 1 second is obviously an accumulator circuit, and a rear flap requiring 3 hp for 20 seconds is a pump circuit—then it is worth while carrying out a fairly detailed weight estimation of the components involved in both types of circuit, not forgetting the weight of air in the accumulators.

b) Method of Driving Hydraulic Pumps

Electric driven pumps have the advantage that they can be positioned in the airplane to suit the hydraulic installation, and if they are mounted near the services demanding maximum power, can save pipe weight. The weights of cables and starting relays, which can be considerable, must be taken into account.

Pumps driven by air motors supplied by engine compressed air are attractive, and favorable ratios of overall weight to achieved hydraulic power can be obtained. To avoid transmitting large volumes of low pressure air long distances it is desirable to mount the air motors near the engines, and consequently the extra lengths of hydraulic pipe must be assessed.

Engine driven pumps have been widely used in the past but the weight of the gear box required may be heavy and the location of the pumps at the engines may increase the weight of hydraulic pipes.

c) Location of Services Demanding Maximum Hydraulic Power

In reviewing methods of driving hydraulic pumps account must be taken of the location of the maximum power demand, and of any weight which could be saved by mounting pumps near to the service involved. For instance, an air brake circuit demanding 20 fluid horsepower at the aft end of the airplane would involve a heavy weight of pipes to transmit hydraulic power from pumps mounted in the engines, and the provision of an electric motor driven pump and tank near the air brake jack could result in an appreciable weight saving. Each airplane must, however, be treated individually and

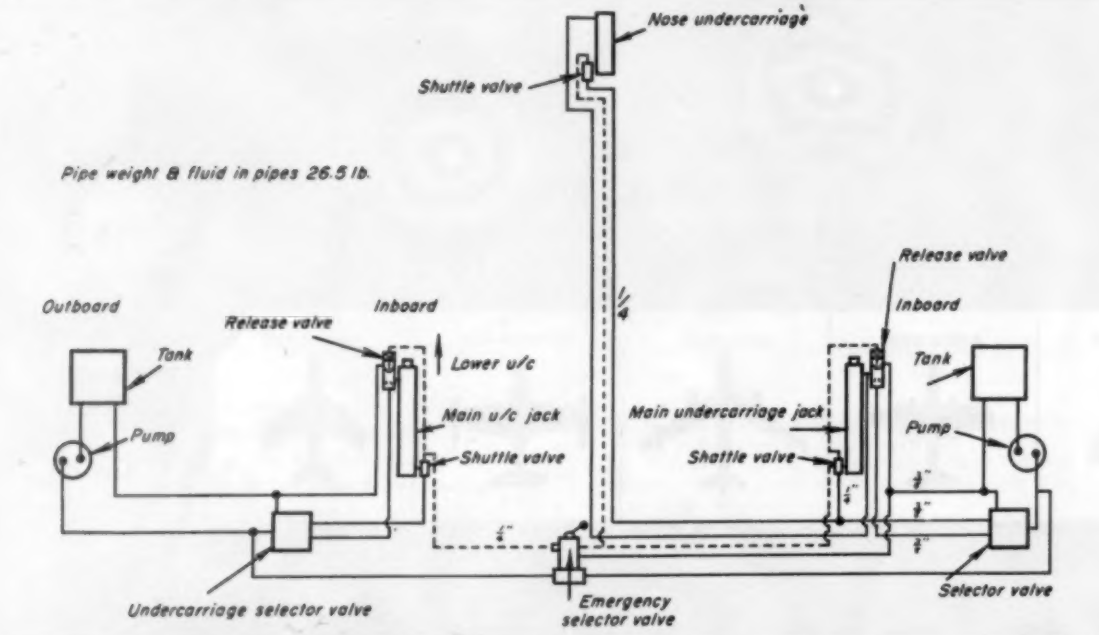
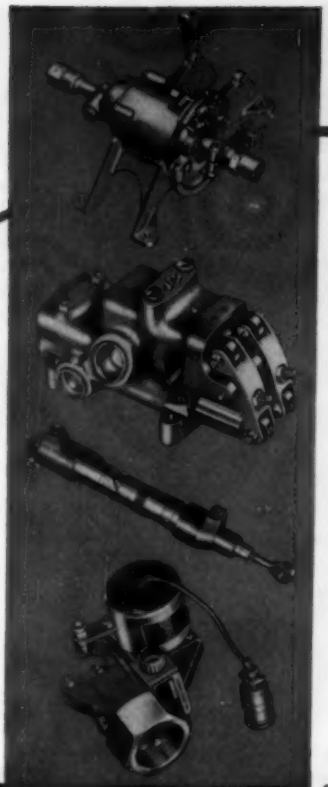


FIG. 1. COMBINED NORMAL AND EMERGENCY CIRCUIT—This comprises a pump driven by the port outer engine supplying hydraulic power for port undercarriage and nose undercarriage retraction, and a second pump driven by the starboard inner engine supplying power for starboard undercarriage retraction. The delivery from the two pumps is combined and fed to the three undercarriages for emergency lowering purposes via an emergency selector and separate pipes. It has the disadvantage that both the normal and emergency circuits are combined at the emergency selector.



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Circle 65 on Reader Service Card

the foregoing could be drastically affected by, say, an inefficient undercarriage retraction geometry demanding large power at the forward end of the machine.

d) Emergency Requirements

Possibly the biggest potential weight saving is to be found in how the emergency requirements of the various circuits are met.

It is usually mandatory that the emergency circuit shall be capable of operating the service should there be any type of failure in the normal circuit, except failure of the jack itself, which by virtue of its simplicity is usually considered to be 100% reliable. The types of failures can be divided into two groups. First, loss of hydraulic power, which can be caused by either failure of the pumps or by a broken pipe or tank, and second, loss of control caused by faults in the selectors or automatic valves. The only way of complying with this requirement is duplication of the source of power, pipes, hydraulic selectors and any other valves.

If, as is frequently the case, emergency operation is acceptable at half normal power, then ideally the lightest system is one employing two circuits, which are both used for normal operation, and either one

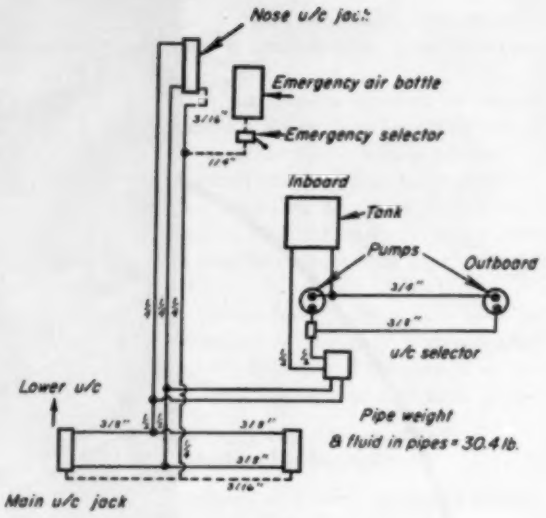

FIG. 2. TWO PUMPS AND EMERGENCY AIR BOTTLE—This is a conventional circuit and has been used frequently. The delivery from two pumps is combined and used to supply power to all the hydraulic circuits on the airplane. A separate air bottle is used for emergency operation. It will be noted that the pipe weights involved are the heaviest of all the schemes considered and in addition there is the weight of the emergency air bottle.

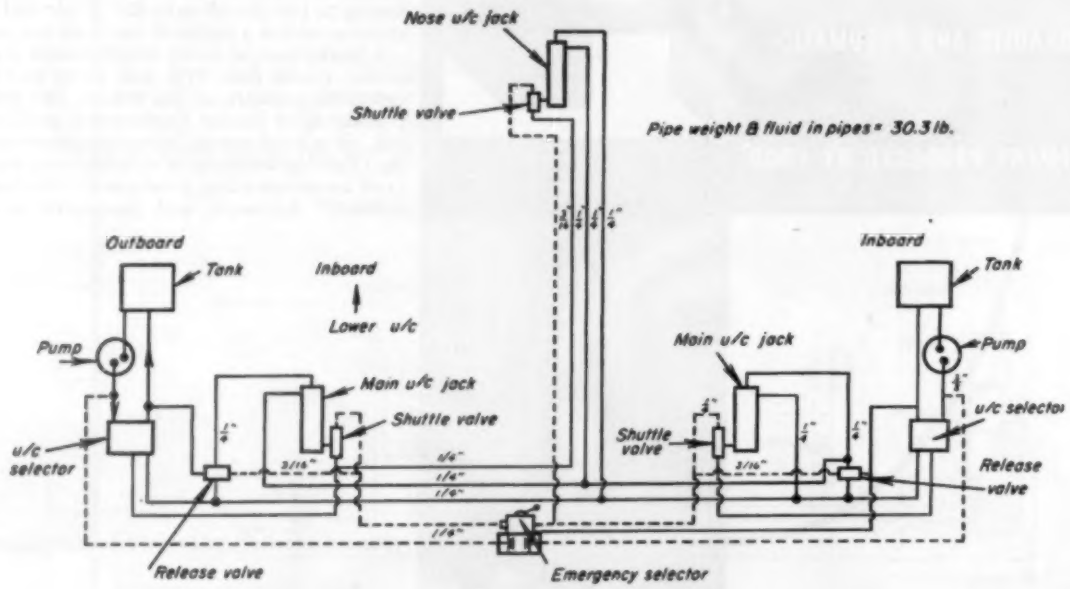

FIG. 3. TWO VOLUME JACKS WITH SHUTTLE VALVES—Two pumps on port and starboard sides of the airplane supply power to the adjacent undercarriage with small diameter pipes running across the aircraft so that hydraulic power is available to retract the three undercarriages should there be a failure of one engine driven pump. The circuit uses two volume jacks for raising so that the oil supply is separated. The delivery from both pumps is combined and taken to the three undercarriage jacks for emergency lowering via separate pipes and an emergency selector. Additional emergency power supply is not needed.

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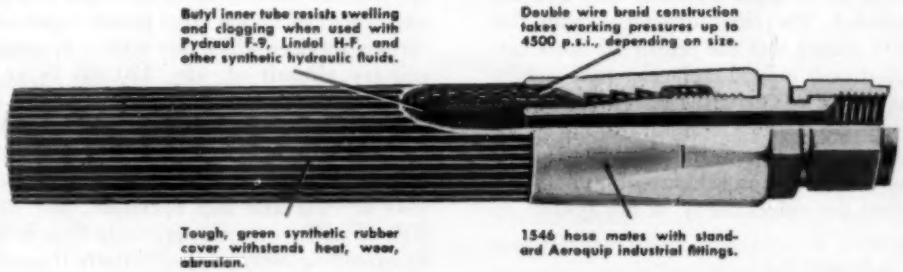
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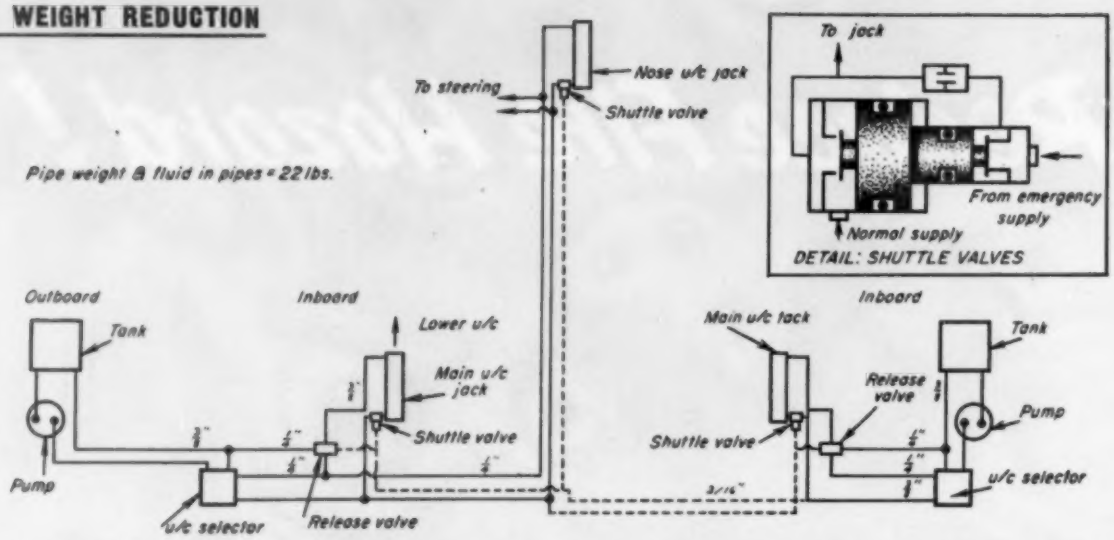

FIG. 4. AUTOMATIC EMERGENCY LOWERING—Oil from starboard pump feeds the starboard undercarriage and nose undercarriage for retraction, and that from the port pump the port undercarriage for retraction. Small diameter branch pipes are taken across the aircraft and form the emergency supply for lowering purposes. A special stepped shuttle valve is used which ensures complete separation of the return oil during retraction, and automatically changes over to the emergency circuit should the normal pressure fail on lowering. A separate emergency selector is not, therefore, required.

for emergency as by this method no additional power supply need be carried for emergency operation, and each set of pipes transmits only half the power demanded. The chief difficulties with this system are to ensure that the return oil flows correctly and that each individual header tank supplying the pumps is adequately filled with oil. To achieve this it is sometimes necessary to mount the header tanks close together with a suitable balance pipe joining each, which in the case of military aircraft increases the vulnerability of the system.

e) Operating Pressures

The choice of operating pressures is a difficult one being a compromise between life and good reliability at low pressures, and reduced weight of components and pipes at higher pressures. It is also complicated slightly by the fact that above certain pressures the weight of some components particularly jacks, must rise as the working pressure is increased. For example, the size of piston rod and cylinder for a jack of given extended length and loads may be decided by strut strength, and in these cases an increase in working pressure may only aggravate the problem. There is thus no general rule for optimum working pressure.* For most cases it is probably between 3000 and 4000 psi, the higher pressure favoring the larger airplane using a comparatively large amount of hydraulic horsepower. However, on one medium size fighter the estimated weight saved in hydraulic components by changing the pressure from 3000 to 4000 psi was 10%, and was explained by the large power consumed by the various services which the system operated. For a military aircraft of, say, 120,000 lb or more a 4000 psi system would certainly show a considerable weight saving compared with one operating at 3000 psi, but for large civil aircraft requiring hydraulic power only for undercarriage retraction, nose steering and flap operation, and demanding high reliability, there is probably little to be gained by exceeding 3000 psi, particularly if some thought is given in the early design stages to obtaining an efficient undercarriage retraction mechanism.

*See "Practical Pressure . . . 3000 psi" by Conrad H. Cooke, May, 1955, APPLIED HYDRAULICS.

f) Control of Hydraulic Power

Hydraulic pipes should be kept out of the pressurized part of the airplane, and consequently remote control of the hydraulic selectors is generally required. This can be done by a mechanical linkage to a manually operated selector, but if the distances involved are large, excessive weight and complexity of the linkage may result. It is more usual, therefore, to employ electro-hydraulic selectors operated by means of an electrical signal, and whose position in the airplane can be anywhere to suit the pipe run. There are two main types, those whose porting is changed by solenoid pilot valves and pistons, and those operated by small electric motors. Of the two types those using solenoid valves seem to be lighter and more compact.

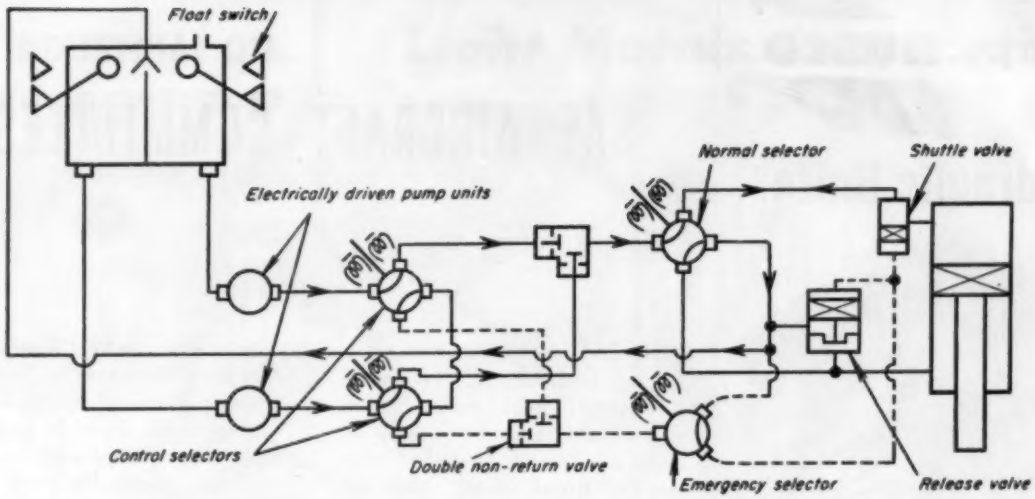

FIG. 5. ELECTRICALLY CONTROLLED CIRCUIT—Two electrically driven pumps draw oil from two separate header tanks and supply pressure to a common normal system delivery pipe via control selectors and non-return valves. The normal circuit selectors are joined to this common supply pipe, and the various circuits are operated by energizing the appropriate circuit selector in the normal manner. Should a fault develop in the normal system, the control selectors are energized and divert the pump delivery to the emergency pipes, and emergency operation is carried out by using the emergency selector, the release valve allowing oil from the jack to return to tank. The float switches in the tank ensure that the pumps are stopped should there be loss of fluid due to a broken pipe, and the selection of the control selectors to emergency over-rides the float switches, and starts the pumps again. A suitable amount of oil is carried in the tank to allow emergency operation after the float switches have operated. Any number of circuits can be added to the system, each additional circuit requiring a normal and emergency selector, and a release valve. The method of connecting the normal and emergency circuits by the control selectors and non-return valves is of interest, as with this arrangement, major damage to any one component can occur and still leave either the normal or emergency circuits functioning.

g) Operating Temperatures

Operating temperatures affect the choice of the oil to be used but most aircraft applications at present in service call for operation between roughly –40°C for the lower limit and +70°C as the upper, which is just within the range given by the standard red mineral hydraulic oil. It affects the weight of the airplane in that sufficient power must be provided to transmit the oil through the pipes at the lower temperatures when the oil's viscosity has increased, and this involves a weight penalty. Various methods of overcoming this have been suggested or tried, ranging from electrically heated lagging to self heating in the system itself. One form of the latter is to employ a hydraulic leak in the circuit, whose rate of leakage is controlled by a plug in a hole, the different co-efficients of expansion between the materials of the plug and of the hole ensuring that the leakage is a maximum at low temperatures and reduces as the system is thus heated.

The high speed aircraft of the not too distant future raise problems at the other end of the scale and will require oil refrigeration or the use of special high temperature hydraulic oils.

CIRCUITS

Figures 1, 2, 3 and 4 show four diagrammatic undercarriage circuits for a civil airplane of approximately 35,000 lbs all up weight using hydraulic power for undercarriage retraction, nose steering and flaps. They were prepared during the initial design stages of a project some years ago to ascertain the saving in pipe weight between the various circuits. The power requirements were defined by undercarriage retraction since the consumption of the flaps and nose steering was small. To obtain a comparison, the pipe sizes were chosen so that the effective pressure difference across the undercarriage jack pistons was similar. During this review the system working pressure was taken at 4000 psi, but it was subsequently found that a saving in weight would be achieved by lowering the pressure to 3,000 psi.

Figure 5 illustrates a type of circuit which might be used on a large airplane and enables the pumps to be positioned so that pipe weight can be reduced.

Figures 1, 3, 4 and 5 incorporate one of the major desirable features, namely that no additional power supply for emergency operation is carried.

This brief analysis of factors which influence weight clearly illustrates the importance of weighing the merits of several circuits for each installation. ▼▼▼

Part 2 will discuss details of component design.

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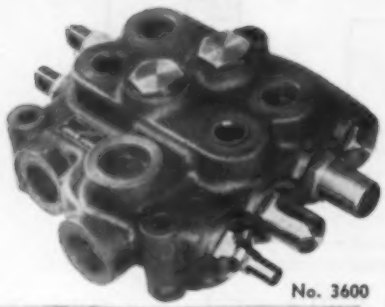

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SAE AIRCRAFT COMMITTEES

THE SAE A-6 Committee, Aircraft Hydraulic and Pneumatic Equipment, held their regular semi-annual three day session on April 27, 28 and 29 at the Sheraton-Mt. Royal Hotel, Montreal, Canada. A record number of over 300 representatives of airframe, airline, suppliers of components, parts and materials, the Services and guests attended. As usual the chairman of the Pneumatic Subcommittee handled a group of pneumatic items, Fred O. Hosterman, chairman of the Materials Subcommittee presided when fluids and packings were discussed and B. R. Teree, Chairman of A-6, held the gavel for the major part of the meeting.

A. H. Hobelmann, Pneumatic Subcommittee chairman, was in the chair for the pneumatic items considered by the Committee.

Specification, Pneumatic, Relief Valve: The chairman reported that the National Bureau of Standards was preparing this spec for BuAer.

MIL-P-8564 (ASG) Specification, Pneumatic Components: The Adel member discussed the recommendations of his Panel as to the information to be included on equipment name plates. He described the single Federal Stock Catalog, prescribed by Federal Law 436, pointing out some of the numerous difficulties involved in getting nomenclature and numbers on small nameplates. After a lot of discussion, the ASG representative expressed the opinion that only new components would be put into the Federal stock system and that the latter would not cover items for aircraft supplied to airframe companies direct from their suppliers. The chairman asked the Adel member to rewrite this part of the spec and coordinate it with other manufacturers.

Specification, Pressure Switch, Pneumatic: The BuAer representative reported that the preliminary draft of this spec would be ready by June 30. The work is being

Continued on page 84

The A-6 Committee at work at Montreal. Right to left: Frank Mittell, North American Aviation; Phil Musa, Grumman Aircraft Engineering; Fred H. Pollard, Republic Aviation Corp.; J. J. Martin, Douglas Aircraft Co., Santa Monica; B. R. Teree, Chairman, Weatherhead Company; Fred O. Hosterman, Weston Hydraulics; A H. Hobelmann, Walter Kidde; Mel Steele, SAE; Ralph Middleton, Lockheed Aircraft Corp.; John W. Kelly, Adel Div. General Metals Corp.; Dave Grant, Hughes Aircraft; Howard Field, Jr., Convair; and H. E. Wells, Bell Aircraft Corp.

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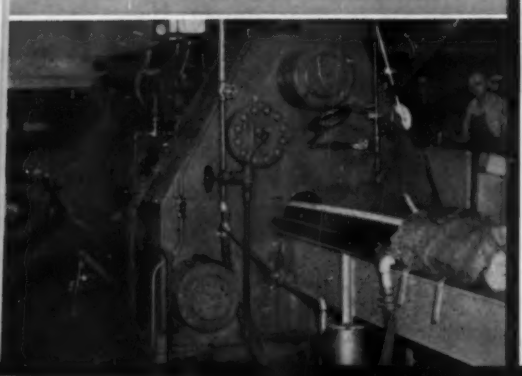

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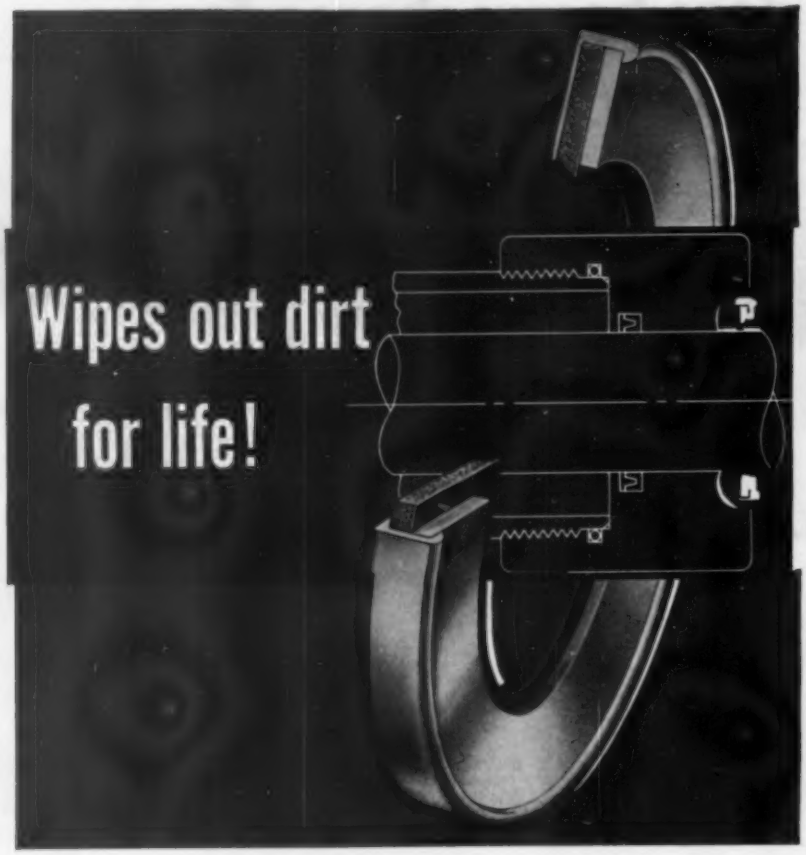

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done at the NBS, where a rough draft is now ready. The Chairman asked that the draft, as soon as ready, be sent to equipment companies for comment.

Specification, Self-Sealing Quick Disconnect Coupling, Pneumatic: The chairman stated that NBS was making some changes and would issue this as a MIL-Aer spec. The chairman asked that comments be sent to him.

MIL-4343, Lubricating Grease, Pneumatic: This grease was again discussed, this time particularly for its suitability for high temperature. There was general agreement that the grease was satisfactory except for gun chargers. The rate of temperature rise was questioned but insufficient test data was available to give a definite answer. One other lubricant, DC 200, was reported as superior to 4343 by one user. The chairman asked BuAer to collect comments for a report at the next meeting.

Pneumatic Packings: The Precision Rubber representative, chairman of the SAE Panel on "O" rings and seals, summarized the results of his questionnaire sent to the industry. He pointed out the steady growth of pneumatic systems on both inhabited aircraft and on missiles. Answers indicate that either new compounding techniques or new materials for seals were required. The range of —65 to 275 F was considered within reasonable possibility but that above 300 F the going was tough.

It was pretty definitely established that no resilient seals (organic materials) would stand a range from 0 to 600 F and that new backup rings or washers for temperature ranges from 275 to 350 F would be necessary, with only teflon in sight at present. Industry answers also indicated that no single lubricant was satisfactory for the extended temperature range that was compatible with present seals.

No information was available on service life (military aircraft).

A group of fluids and packings were next considered. Fred O. Hosterman, chairman of the Materials Subcommittee, acted as moderator for this part of the agenda.

Because of the importance of the high temperature problems, the items, both fluids and packing materials, were considered in two

groups: one for 275 F systems, the other for 400 F systems.

High Temperature Hydraulic Systems — 275 F: The Services reported that no satisfactory packings have come to their attention that would pass MIL-P-18017. A total of about 80 materials have been tested to date. Suppliers were asked to keep the Services advised of new developments.

The dot system of marking for "O" rings was again reviewed. This system of identification of "O" rings, called for by drawings of MS28784 and MS28785, has not proven too successful. Several airframe representatives reported that at least half of the leakage and breakdown of "O" rings occurred in the area of the inserted dot on the rings. However, the Services ask to keep the dot marking system. The two MS drawings have been combined and reported to ASG. Additional small sizes have been approved by WADC.

MIL-O-5606 Specification, Hydraulic Fluid: The chairman of the "O" Ring Panel reported that five packing compounds operating in MIL-O-5606 at 275 F exhibited a swell from 20 to 26 percent by volume.

The problem of water contamination of MIL-O-5606 was discussed in an effort to determine if a tolerable contamination in percent by volume could be determined. The North American member reported a contamination of .81 percent by volume in 15 aircraft systems after an average service life of 300 hours. He suggested, however, a permissible volume of one-half of one percent as the maximum. The Northrop member reported a series of tests, still incomplete, on water contamination of servovalves. In the freezing test, one percent, two and a half percent and five percent water was added. He reported no greater difficulty of operation.

MIL-P-5514 Specification, Packings; Installation and Gland Design of Aircraft, Pneumatic: T. J. McCuistion of Parker Appliance Co. presented a short paper on new gland designs under development for high temperature aircraft hydraulic and pneumatic seals. Several new designs of organic and metal seals were illustrated and described. (This paper, somewhat expanded, will appear in an early issue of APPLIED HYDRAULICS.)

The WADC representative reviewed the tests made in the Ma-

Continued on next page

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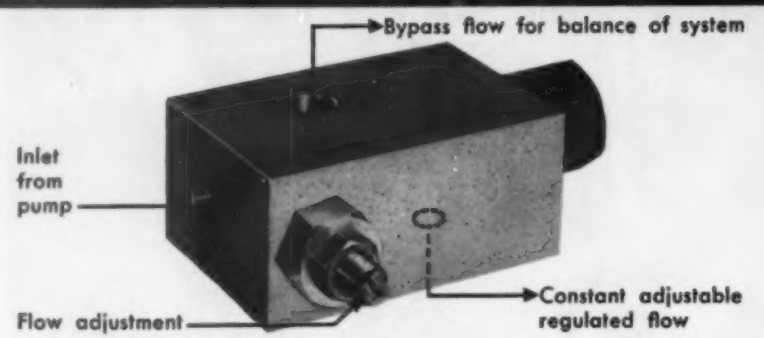

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terials Lab on 80 and 90 Shore organic seals and metal seals. He asked that suppliers send seals for testing. The Republic member reported quite satisfactory results in testing AND 10050 metal boss seals at temperatures up to 500 F.

Equipment Testing at 275 F: The North American member reported on the work done by a Panel and briefly reviewed the recommendations made by the Panel. The minutes of the Panel meeting were ordered incorporated into the minutes of the A-6 meeting.

The Purolator member outlined the results to date on a survey on methods of evaluation for high temperature hydraulic filters. The Chairman asked him to Consolidate comments and send them to the industry.

High Temperature Hydraulic Systems — 400 F: A representative of the Materials Lab, WADC, outlined the test work to date on several of the more promising high temperature fluids. OS-45, a silicate fluid, 720173, an interim fluid soon to be replaced by 720173C, and 8515 (a WADC modification of 8200) were specified as the most promising. However, other fluids are developed and in the testing stage and at least two leading suppliers expect to have such fluids ready for service testing soon.

High Temperature Hydraulic Systems — General: The WADC representative outlined report AE-61-8 on methods of storing, handling and filling aircraft systems as well as the ground testing of high temperature aircraft hydraulic systems. Copies of Report AE-61-8 are available from the Bureau of Aeronautics, Navy Department, Washington 25, D. C.

MIL-P-5516 Specification: The ASG representative reported that an ANA Bulletin on Age Control Requirements will be issued in from 60 to 90 days. The Bulletin does not change the spec.

The Bendix member of the "O" Ring Panel reported that a standard drawing on the "D" Ring was in preparation. This will be sent to the Services.

MS 28782 & MS28783 Back-up Rings: The Douglas, El Segundo representative reported on the status of Survey SAE A-6-89 on back-up rings. He found that while

some difficulties were encountered and there was no general agreement as to what should be done, it was agreed that spiral rings, especially in the smaller sizes, should be changed. The Chairman asked Bendix-Pacific to run tests and make suggestions. Weston Hydraulics is to assist.

At this point Chairman B. R. Teree took over the gavel for the rest of the items on the agenda.

MS28720 Filters, Line Type, Hydraulic: The North American member proposed a re-design in this filter so that the element is held in the bowl and remains with the bowl during removal and assembly. The Chairman asked BuAer to study this proposal and report at the next meeting.

Hydraulic Tubing Specifications: The WADC representative suggested a new tubing burst formula and discussed the proposed specification changes in regard to the removal of major surface imperfections. There was no general agreement as to what to do about the surface imperfections other than the present airframe and airline stock inspection but the Chairman asked that the new formula be coordinated with BuAer.

The TWA member reported that 76 percent of their service trouble with AN type hydraulic fittings was due to loosening of "B" nuts and asked if self-locking nuts, required on all aircraft structural connections, could not also be used on hydraulic connections. No action was taken.

At the special invitation of the Committee, Kenneth G. Hancock, chief hydraulic designer, Electro-Hydraulics Ltd., a major supplier of aviation hydraulic components in England, gave a short paper on makeup of the leading English firms that are direct suppliers to the aircraft industry.

MIL-C-5502 Coupling, Aircraft, Hydraulic, Self-Sealing: The WADC representative brought the Committee up to date on the status of the latest changes in this spec. The present type (Type 1, Aeroquip) is used for ground connections; a new envelope drawing is in the mill and is expected to be ready within 60 days (issued by BuAer); a development contract for a high temperature coupling will shortly be issued.

The North American member made three suggestions for revising the envelope. The Chairman asked that the revised drawing be sent to BuAer.

MIL-C-5503, Cylinders, Aircraft, Hydraulic Actuating: The Adel member reviewed industry information in regard to scraper rings, considering felt wiper rings only. One small change was suggested. The Republic member stated that no felt wiper rings should be used at temperatures above about 225 F, since the rings charred and invited trouble. The chairman appointed a sub-committee of the Adel, Lockheed and Weston Hydraulics members to determine if any changes would be made. The ASG representative agreed to make the changes promptly in the drawing.

Corrosion Resistant Materials: In spite of long discussion on this item, no change was recommended on this item.

MIL-V-5523, Valve, Relief, Hydraulic Pressure: The latest revision of this spec has been completed and will be issued by BuAer in 30 days.

There have been some discrepancies in the performance criteria for the three classes of valves specified. The Chairman asked the Lockheed member, chairman of the Relief Valve Subcommittee, to revise the spec on the basis of the recommendations agreed upon.

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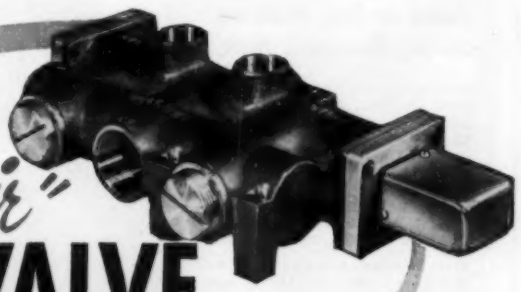
NEW "Bel-air" AIR VALVE



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With Custom Features Found on Test Machines Costing Thousands More!

Structure. A 16-gage welded steel cabinet. Size 48" wide, 64" high, 46" deep. Weight 900 lbs. Casters can be supplied for portability.

Two Pressure Gauges. Range 0 to 5000 psi for indicating system pressure and checking pressure on test components.

Oil Temperature Gauge. Range of 30° to 210° F. for recording oil supply temperature.

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Flowmeter. 250mm scale "Rotometer" type with range of 0.6 to 7.4 gpm to measure within 2% accuracy.

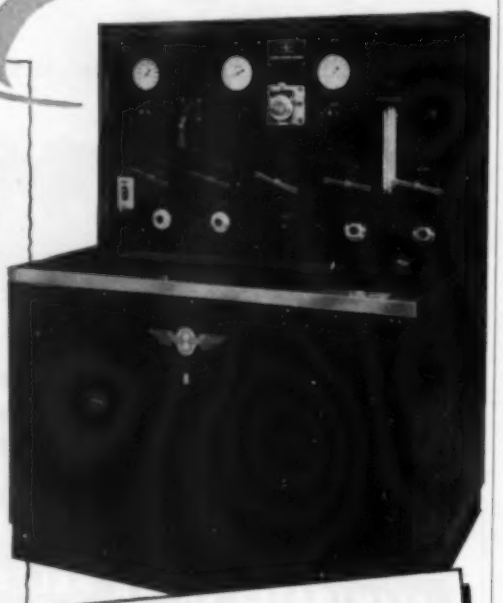
Selector Valve. 4-way closed center valve and panel ports equipped with shutoff valves for actuator cylinder testing.

Pump. Axial piston-type with constant flow capacity of 6 gpm at 1800 rpm and 3000 psi.

Reservoir. 15-gallon steel tank with removable cover. Includes sight gauge, micronic filter, supply, return, and all drain connections.

Cooling Circuit. Includes a thermostat, oil cooler, water strainer, shutoff valve and all water connections.

Write or call for details on the JK-100. Better still, have a Greer engineer visit you.



A High Calibre Test Machine — Built for Fast, Accurate Production and Built for Trouble-Free Service!

Greer Model JK-100 can accurately test all types of hydraulic components (valves, cylinders, regulators, etc.) at pressures to 3000 psi and flows to 6 gpm. It was especially designed for airlines, overhaul shops, airports, aircraft and industrial plants where production is a big factor, but prices paid for test equipment is a bigger factor. You'll find the JK-100 is just what you need for accurate, dependable performance, *and the cost is remarkably low.* This unit meets rigid JIC, AN and MIL standards too. Remember, it's built by Greer craftsmen and backed by the Greer guarantee for as long as you own it. Get all the facts today!

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GREER HYDRAULICS INC. • N. Y. INTERNATIONAL AIRPORT • JAMAICA 30, N. Y.

Field Offices: Chicago, Dayton, Detroit, N. Hollywood • And representatives in principal cities

SAE AIRCRAFT COMMITTEES

MIL-H-8775, General Specification, Hydraulic Components: The Republic member pointed out that this spec should be revised to include temperature ranges now called for by the industry. Members agreed and the Chairman turned the assignment over to the High Temperature Panel for coordination. BuAer is to issue the revised spec.

Contamination of Hydraulic Fluid in Aircraft Hydraulic Systems: Gerhart Reethof of the Dynamic Analysis and Control Laboratory, MIT, outlined studies made in the Lab on the nature and size of contaminants in hydraulic fluids in aircraft hydraulic systems. He divided contaminants as: (1) silica dust; (2) metal particles; (3) rubber particles; and (4) filter particles. He also discussed the small micron (2 and 5) filters, pointing out how particles much larger than the rated size of the filters are able to pass through the filters.

Proceedings of the SAE-3 and A6-C Aircraft Committees Meetings will be published in the JULY issue.

Filtration Problems in Servovalves: The North American, Downey, representative, picking up the discussion from the Reethof discussion, pointed out that with modern electro-hydraulic servovalves, radial clearances are often less than 2 microns and that even filters rated at 2 microns will pass particles much larger. Such articles silt up the valve and abrade the metering edge. Also, his company finds that metallic particles of 1 to 1½ micron size tend to collect on magnet pole faces and alter the valve characteristics. They have found it advisable to go to sintered metallic elements for all temperature ranges. The M. C. Manufacturing Co. representative agreed that fine filtration has become a very serious problem. Several filter manufacturer representatives maintain that effective 2 and 5 micron filters can be built but that size and flow rates are problems that still must be solved.

The Chairman, B. R. Teree, announced that the next meeting of A-6 would be held at Miami Beach, October 5, 6 and 7. ▼▼▼

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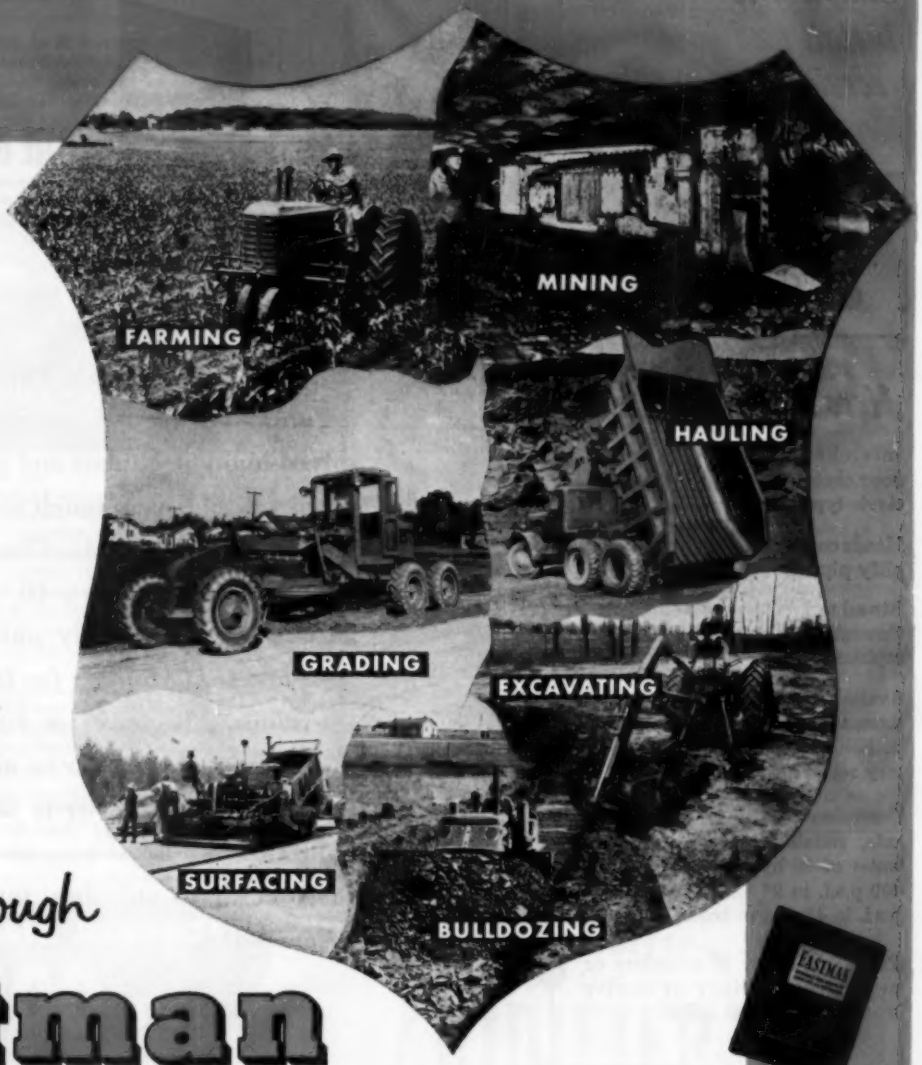

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Air and Hydraulic
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Member of National Fluid Power Association

Ideas from a Sales Engineer

Elmer F. Heiser

During Elmer Heiser's 18 years of selling air and hydraulic components, he has solved many problems and has left some unsolved. Between, much too infrequent fishing trips to Canada, Elmer makes his sales calls in northern Ohio. He is the author of the recently published book "*Air and Oil Cylinders for Industrial Applications*". Because we enjoy learning of Elmer's experiences and opinions, we've asked him to write these monthly columns. We hope you too are finding these columns amusing, interesting and informative.

How to get 5 answers to one problem

LAST month a hypothetical problem was posed to determine which hydraulic system was a "good" system. In the problem, it was suggested that five different systems were offered to answer the same set of specifications. Which was the right one?

It is entirely possible that five completely different answers will result if the same basic problem is submitted to five different hydraulic engineers. Of course the five answers would contain five different pumps, if the problem is submitted to five different pump suppliers. Different sources would likewise account for differences in valving, etc.

We can prepare an interesting case by leaving the suppliers out of the picture. Let's submit the same problem to five different engineers, who, though acquainted with suppliers, have no connection with any particular manufacturer of hydraulic components. We can pick out those who have been engaged in the design of machinery on which hydraulic equipment is applied. Very often such application experience makes one better qualified than those engaged in making the component parts.

How could five competent engineers come up with five different answers to the same problem. Easily. In the first place, the answer of each will depend on several things:

1. His interpretation and analysis of the problem.

Circle 12 on Reader Service Card

What are the Advantages of Plastics for Air Valves?

If you have been looking for low cost dependability here is a continuous duty direct solenoid valve for 200 psi with full ¼" orifice which costs less than most hand operated valves. The body is machined from tough canvas base phenolic with pipe ports perpendicular to the laminations. No need to baby this valve because the resilient construction will absorb punishment that would damage harder materials.

BACHMAN ¼" Solenoid Valve
4-way, 3-way or 2-way for 110 v. Price $12.75

4-way piped exhaust, slightly higher.

With this unit you can operate, check or cushion an air cylinder. On the oil side of an air-hydraulic system the same valve will provide positive check or dwell. Use it for many combinations of manual and automatic control. It is 7" long, weighs 2 lbs. and mounts in any position. Other models have double solenoid and also hand, foot or mechanical actuation. All have ½" stroke and spring return is optional.

Ask us to send you one of these units for a 30 day test and decide for yourself whether this long life leakproof valve can save you money.

Made and guaranteed by . . .

John D. Bachman & Co.
Bristol, Tennessee

BOOST 100 PSI AIR PRESSURE TO 30,000 PSI FLUID PRESSURE

for . . .

$289.50

(F.O.B. Gardena, Calif.)

Continuous-acting, air-driven. Various ratios give maximum fluid pressures of 100 to 50,000 psi. Size: 8¼" wide x 9⅝" deep.

Eight standard models. Special models for lower or higher pressures. Applicable wherever low-volume output at high pressures is the requirement, such as static testing, powering presses for forming, shearing, clamping, etc. Thousands in use. Complete power packages also available. Send for Bulletins.

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Circle 40 on Reader Service Card

I NEW GAST Model 0211 AIR PUMP weighs ⅓ less — is a truly

COMPACT COMPONENT

This *new* Gast rotary-vane Air Pump offers many advantages, including: ⅓ less weight — (now 22 lbs.) — with more compact, streamlined design. Rotor mounted on new G. E. Form "G" motor shaft. Vanes give positive, pulseless air delivery. Rubber-cradled mounting dampens vibration, increases quiet.

Model 0211 produces up to 25 p.s.i. or 27" vac., or 1.3 c.f.m. running open. ⅙ h.p. motor uses only 3.8 amps. Ideal for automatic machines, industrial instruments and controls. Present uses: paper feeding in packaging, printing frames, or as portable laboratory air source.

Let *your* product benefit from this compact component — *write for Bulletin 1254 and "Application Ideas" Booklet!* Gast Manufacturing Corp., P.O. Box 117-D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
• AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File

EQUIPMENT LASTS LONGER . . . PERFORMS BETTER . . . when the

ARIDIFIER

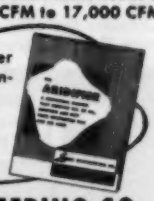
SCRUBS, CLEANS AND DRIES On Air and Gas Lines

LASTS LONGER because . . .
The Aridifier's patented centrifugal-baffle action traps 92% of all dirt, oil, scale and water in gas or compressed air . . . and drains off these troublemakers *before* they can damage tools and equipment.

PERFORMS BETTER because . . .
The Aridifier protects tools against the freezing, fouling, caking and corrosion caused by dirt and foreign matter . . . assures the clean, dry air and gas that means better spray work, painting, lacquering, sand blasting, air cleaning, and similar operations.

Easily installed, the Aridifier maintains itself. 10 models. Capacity range; 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.
Write for This Catalog Now!



Logan ENGINEERING CO.
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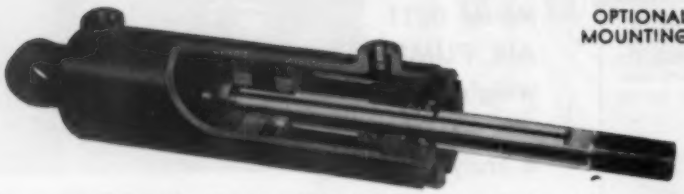
Circle 16 on Reader Service Card

COMPACT | DEPENDABLE | EFFICIENT

Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS



It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

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Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

BENTON HARBOR ENGINEERING WORKS, Inc.

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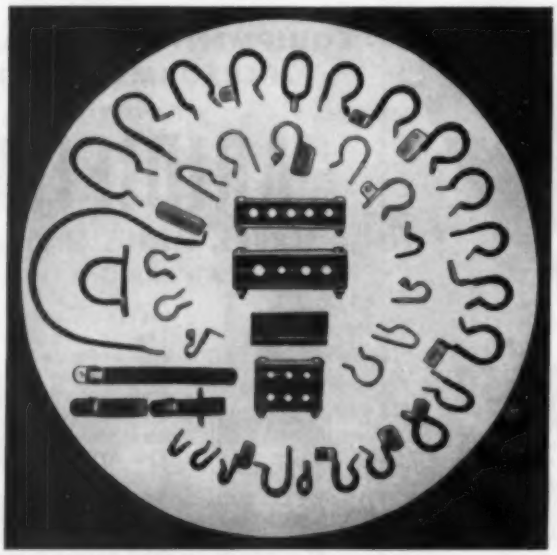
Cost Saving Ideas...



15,000 different types and sizes of LINE SUPPORT CLIPS, LINE SUPPORT BLOCKS and HARNESS STRAPS for positive, vibration-free support in aircraft, marine and industrial installations.

Consider the advantages of standardization — *completeness of line — a smaller and more flexible inventory — quick and easy training of personnel — safety — durability — interchangeability — ECONOMY ... Specify ADEL*

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Ideas from a Sales Engineer

Continued

2. His background and experience
3. His preferences, prejudices and thinking habits
4. His imagination.

Let's take the first one. The analysis and interpretation of the problem. This point alone can account for a very wide difference in answers. To assume that the problem is so well and so completely stated that there is no room for differences in interpretation is unrealistic. That could only happen if either you or I set up the specs; most other people leave something for the imagination. One person will take the specs as supplied and immediately proceed to work out his hydraulic system while another starts asking questions and digging deeper. How many questions he asks and how deeply he digs may make considerable difference in the answers he comes up with.

OUT IN THE COLD

I didn't ask enough questions once and was practically tossed out. This fellow wanted to know about hydraulic equipment to move something through a seven inch travel at 50,000 pounds force in too few seconds. Just as a starter, I buzzed through some figures to see what horsepower was involved and came up with twenty-five. I hadn't even begun to ask my real questions. He heard me say 25 hp, let out a snort and said he does the same thing on a punch press, with 3 hp. I tried to say that he didn't give me the right dope to start with but I was outside before I figured out what questions I should have asked before starting my answers. He probably still thinks a fly-wheel can beat any hydraulic system.

Very few of us are gifted with the ability to create things outside of our experience. Obviously we draw on experience, leaning heavily on that which is familiar to us when we answer new problems.

With such natural human limitations we could expect that each

Continued on page 94

Solenoid VALVES

PILOT VALVES
3-WAY 4-WAY
For operating
Master Valves and
Small Cylinders

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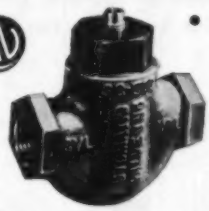

***Speed Control* VALVE**
Controls speed of
Air and
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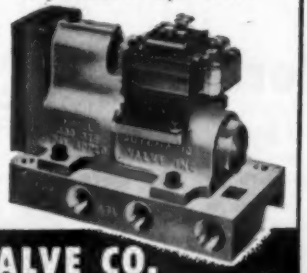
***3-Way and 4-Way* VALVES**
Pilot Operated
Sizes ¼" — ⅜"
½" and ¾"
Write for Bulletin



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"MONOBALL"®

Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Moly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Moly Steel Ball	For types operating under normal loads with minimum friction requirements.

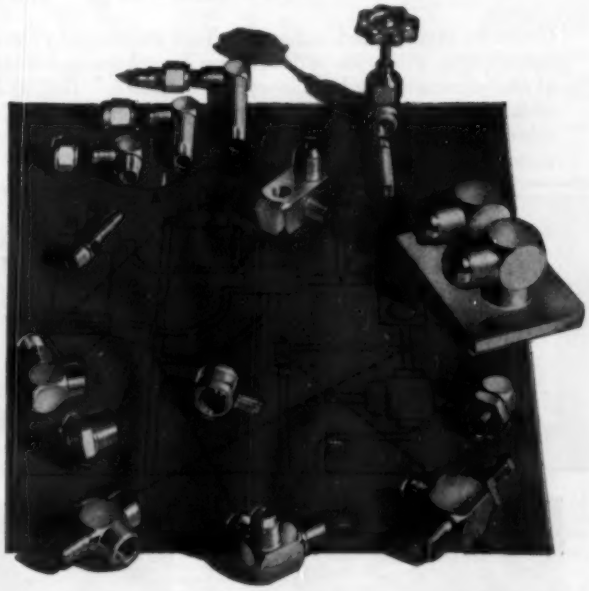
Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. AH-55.

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. • Duarte, California
(LOS ANGELES COUNTY)

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
Flange Mounted — "O" Ring Seal



A—JIC Flare Tube Fittings	G—Ball Check Valve
B—Manifold Fitting	H—Lateral Outlet Fitting
C—Needle Valve	I—Universal Elbow
D—Pipe Nipple	J—Dryseal Pipe Fitting
E—Flange Manifold	K—Hex Reducing Bushing
F—Straight Thread, "O" Ring Seal Fitting	L—Swivel Elbow
	M—Barbed Hose Stem

You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

Distributors in principal cities
Write for catalog No. 53

L and L MANUFACTURING COMPANY
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Ideas from a Sales Engineer

Continued

man would stay within a comfortable radius of familiarity in arriving at his answer to the problem. The answer thus would be considerably affected by the extent of previous experience, knowledge and background.

We likewise develop preferences and prejudices which color our answers. In one engineering department, I know an old timer who still remembers that some fifteen years ago one of their men came out second best in a physical tussel with a "hydraulic gadget" of a certain make. To this day he won't allow anything with a name even remotely resembling it to darken one of their drafting boards. We also tend to fall into patterns of thought which determine our procedure on a new problem. One fellow does every thing with solenoid valves while another engineer will make any new job pilot operated. One is sure that variable volume pumps are best for any application while another is sold on the idea that anything which can't be done with constant displacement pumps isn't worth doing.

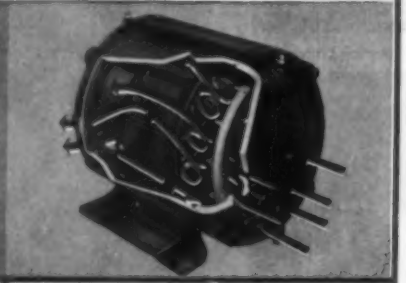
Such things in human behavior must be accepted and the answers with them. Of course the last item, imagination can be good or bad. Imagination can overcome the limits imposed by the first three mentioned but it can also run into wild answers.

To HYDRAULIC ENGINEERS, Howell suggests

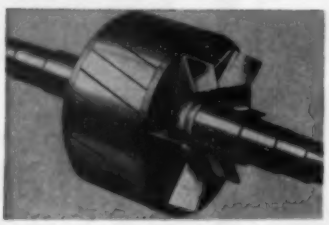
What to look for in Part-Winding Motors

If you've investigated reduced voltage starting of centrifugal pumps, compressors, etc. with part winding (synchronous) motors, you know of the economies and efficiency to be gained.* But, as in other types of motors, manufacturers' constructions differ considerably. Below are some points for comparison . . . and a few of many reasons why Howell motors are so outstanding!

VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!



BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-wound rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICH.

"Yezzir, my invention will revolutionize the industry"

Speaking of imagination. As all salesmen do, I followed an inquiry once which sounded like it had a real potential. In fact the letter of inquiry stated that the writer was planning to apply our equipment to a new development which would revolutionize an entire industry. The starting point of this revolution was a bit of a jolt. We wandered in and out of the subject for a while (he wandering out) until I learned that another of his projects was aimed at revolutionizing forestry. He was well along, he said, with his experiments in crossing asparagus with pine trees. This when accomplished would result in timber reforestation at the growth rate of asparagus. That's when I wandered out. Just think how a deal like that would mess up the nesting habits of our feathered friends. Besides what does it have to do with hydraulics?

▼▼▼

Next month: All about dogs and circuit symbols.

ANNOUNCING THE NEW LINE OF PALLEY HYDRAULIC CYLINDERS

CUSTOM BUILT AT MASS PRODUCTION PRICES

Our 10 years experience in filling the needs of Aircraft and Heavy Industry for Hydraulic Equipment have led us to the engineering and development of this all new line of Industrial Hydraulic Cylinders. Designed especially to meet the most rigid requirements of industry. All are double action with rugged steel construction throughout. Made to take pressures up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on the 3000 PSI types. Have male clevis mounts on both ends.

We are also equipped to Custom Manufacture to your specifications. Write us Today for further details or expert advice on your problems.

PART NO.	BORE	STROKE	SHAFT	PSI	Type of CAP	THRUST	PRICE
PH34E	3"	4"	1-1/8"	1500	External Threaded	10,500 lbs.	$32.50
PH36E	3"	6'	1-1/8"	1500	" "	"	35.00
PHE1	3"	8"	1-1/8"	1500	" "	"	37.50
PH312E	3"	12"	1-1/8"	1500	" "	"	42.50
PH34I	3"	4"	1-1/8"	1500	Inserted	"	32.50
PH38I	3"	8"	1-1/8"	1500	"	"	35.00
PH45E	4"	5"	1-1/8"	1500	External Threaded	18,750 lbs.	37.50
PH46E	4"	6"	1-1/8"	1500	" "	"	39.50
PH48E	4"	8"	1-1/8"	1500	" "	"	43.50
PH410E	4"	10"	1-1/8"	1500	" "	"	47.50
PH412E	4"	12"	1-1/8"	1500	" "	"	51.50
PH45E3	4"	5"	1-1/2"	3000	" "	37,500 lbs.	52.50
PH46E3	4"	6"	1-1/2"	3000	" "	"	54.50
PH48E3	4"	8"	1-1/2"	3000	" "	"	58.50
PH410E3	4"	10"	1-1/2"	3000	" "	"	62.50
PH412E3	4"	12"	1-1/2"	3000	" "	"	66.50
PH518I	5"	18"	2"	3000	Inserted	59,250 lbs.	85.00
PH524I	5"	24"	2"	3000	"	"	107.50
PH530I	5"	30"	2"	3000	"	"	130.00
PH636E	6"	36"	2"	3000	External Threaded	86,625 lbs.	265.00

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW-HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore. 13" stroke. 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds. . . **95.00**

GB-8-25 TON HYDRAULIC CYLINDER
Same as above except has 8" bore, 15" stroke. Will give 50000 lbs. thrust at 1000 PSI. Shipping weight 185 lbs. **105.00**

SAVE UP TO 85% ON GOV'T SURPLUS

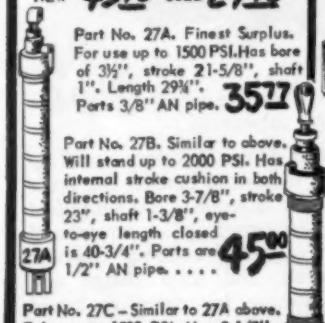
SPECIAL

SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.
NEW **43.95** USED **29.95**

TELESCOPING HYDRAULIC CYLINDER

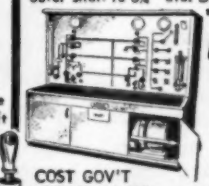
Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¼" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**



Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Ports 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**

Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**



COST GOV'T APPROX. $6000 **$1495**

AIR ASSOCIATES HYDRAULIC TEST STAND

Electric motor driven type. Has a 2500 PSI Hydreco Pump which delivers up to 10 GPM. Powered by 15 HP, 3 phase motor using 220/440 volt, 60 cycle current. Unit has selector valves, pressure gauges, flow meter, reservoir, heat exchanger and filter pressure regulator. Mounted on steel frame. Has work bench, flourescent lights and hand operated, high pressure pump for testing to very high pressures. Overall size: 8ft. long x 7ft. high x 4ft. deep.

HYD. TEST STAND – Same as above but has a Reeves variable speed reducer to control the pump output as desired. **$1895**

NEW 10 TON HYDRAULIC PRESS

Here is a rugged 10 TON Arbor Press you can use in the shop or take with you on the job. Has sturdy frame of 4" welded channel iron. Press has 4-1/4" stroke, 2-1/2" diameter ram. A control valve operates the piston in both directions. Platform is adjustable. Has positive power Hand Pump. 2000 PSI pressure gauge. NEW **129.00**

NEW SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **44.50**

4" SPLINE SHAFTS for input and power take-off on above. $2.50 pair

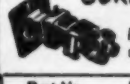
INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

NYD. HAND PUMP

12.75

Top condition. Has operating pressure of 1500 PSI. Capacity of 1.5 cu. in. per complete cycle.

SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS



Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	$29.75	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
PF50-3915-30YG	1.520	19.7	3000	3000	—	200.00
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF9-713-30BCF	.600	9.75	1000	3750	$37.50	
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

PESCO HYD. PUMP

A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

STRATO POWER HYDRAULIC PUMPS

Designed and built to finest aircraft specifications.

PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	2	1400	3750	NEW $27.50
67WF300	3	1500	4500	USED 72.50
67WJ800	8	3000	4500	USED 87.50

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware. Send us your requirements.

NOTE: Items shown here are only a small part of our tremendous stocks. We have over 100,000 Hydraulic Cylinders in 106 sizes and types. Also all type Valves, Pumps, Motors.

Order from this Ad. Pay by Money Order or Check. P.O.s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

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2263 E. VERNON AVE., DEPT. AH-6, LOS ANGELES 58, CALIFORNIA

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to assure dependable performance

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AIR-HYDRAULIC

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Complete testing facilities at our modern new assembly plant take the guesswork out of cylinder performance. Before shipment every O-M Air and Hydraulic Cylinder is "power-tested" and approved, assuring dependable prolonged service under all normal operating conditions.

Standard, semi-standard, "special" air and hydraulic cylinders available in full range of sizes (1½" to 8" bores with standard, 2 to 1 or oversize rods. Completely interchangeable parts. Immediate delivery on many sizes.

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1 143RD STREET, HAMMOND, INDIANA

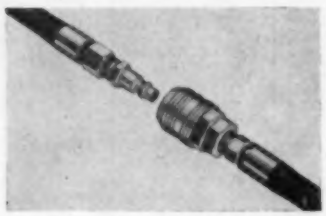
☐ Have representative call ☐ Send latest catalog
☐ Send ½-scale templates

Name_____ Position _____
Company_____
Address_____
City_____ Zone____ State_____

New Products continued

HOSE COUPLER
. . . has swivel action

Features: Compact coupler is connected with plug-in action without twisting or turning. Connection is firm and withstands strong pull, yet can be easily disconnected. Swivel action of coupler prevents kinking.



Made of stainless steel to resist corrosion.

Specifications: Made for ¼, ½, and ⅜-in. hose. Couplers can be used interchangeably and fit other makes for quick assembly where variety of hose sizes are used.

Aro Equipment Corp.
Bryan, Ohio

Circle 136 on Reader Service Card

AIR SUPPLY UNIT
. . . for aircraft servicing

Application: Service cart supplies 3000-psi dry air for ground servicing of aircraft. It duplicates the pneumatic system in the airplane and provides air for charging tires,

struts, hydraulic accumulators, emergency air bottles, and for ground starting of the fuel-air combustion starter without drawing on the pneumatic system of the airplane.

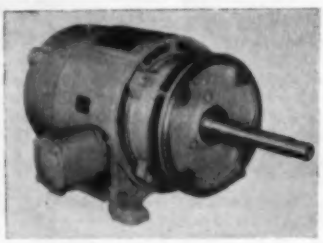
Design: The unit has a 4-stage, radial piston air compressor which delivers 4 cu. ft. of free air at sea level compressed to 3000 psi. The compressor, driven by a 4-hp gasoline engine, delivers the air to the 1300 cu. in. sphere for storage. A moisture separator and chemical drier between the compressor and air storage bottle dries the air to a dew point of 65°F. A valve and gaging arrangement permits setting the air pressure to any point between 50 and 3000 psi for servicing the aircraft.

Walter Kidde & Co.
Belleville, N. J.

Circle 137 on Reader Service Card

ELECTRIC MOTOR
. . . for centrifugal pumps

Features: Explosion-proof motor is for driving a centrifugal pump in dangerous, damp, or dusty locations and is completely sealed for use in locations with explosive dusts, acid



fumes, excessive moisture, or other harmful substances.

Design: Motor has face-type registered mounting bracket for accurate shaft alignment and simplified pump mounting, precision ground shaft for accurate pump impeller mounting, and solid flange and brass slinger for complete liquid deflection. Explosion proofing is accomplished with specially sealed conduit box, elongated bearing sleeves, sparkproof aluminum fan, and long bracket registers.

U. S. Electrical Motors Inc.
Los Angeles, California

Circle 138 on Reader Service Card

AIR VALVE
. . . incorporates speed control

Features: Valve has adjusting screws in the end caps which restrict the flow of cylinder exhaust air through the valve. Valves already in service can be converted for in-

Continued on page 98

Sure you're protected by HOUGHTO-SAFE

. . . and you're getting HYDRAULIC EFFICIENCY too!

Houghto-Safe is a water-base hydraulic fluid. It is fire resistant—and is just as efficient as it is safe.

Good lubricity protects your machines and parts against wear.

It's also non-corrosive and non-toxic. Prevents rust and corrosion in your hydraulic system. Has no unpleasant odor and is safe for workers to handle.

Houghto-Safe won't attack packings, either—has no ill effect on the standard packing materials you use.

Considering these and its other performance benefits, non-flammable Houghto-Safe should be *your* first choice in operating hydraulic equipment. Ask the Houghton Man how it applies to your particular needs—get latest bulletin promptly, by writing to E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

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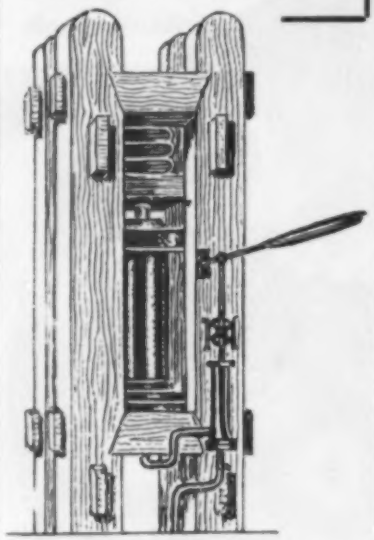
Ready to give you on-the-job service . . .

Circle 48 on Reader Service Card

Circle 50 on Reader Service Card

THE FIRST HYDRAULIC PRESS WAS A BRITISH INVENTION BY JOSEPH BRAMAH, AND THE FORERUNNER OF ALL HYDRAULIC PRESSURE MACHINES



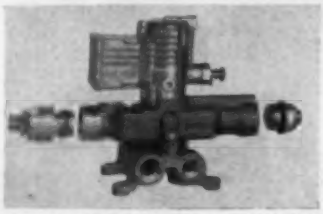
BRAMAH PRESS 1795

The HYDRAULIC ASSOCIATION of Great Britain

94/98 Petty France, London, S.W. 1 England

New Products continued

tegral speed control with a kit supplied by the company. Adjusting screws restrict the stroke of the

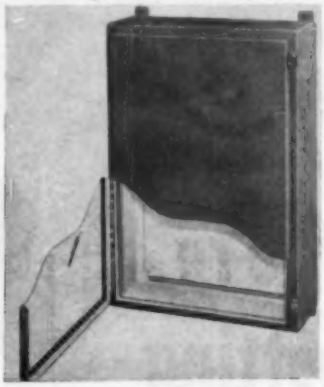


main stem of the valve. This eliminates excess piping and maintenance costs and the need for one or two separate flow control valves. Valves are available in ¼, ⅜, ½, ¾, and 1-in. sizes.

Valvair Corp.
Akron, Ohio
Circle 139 on Reader Service Card

ELECTRICAL ENCLOSURE . . . for oil-tight installations

Construction: Enclosure is completely liquid tight. All seams are welded, and there are no holes. Cover is gasketed with neoprene sponge, and is fastened to the box with continuous-type hinge. Unit has mounting feet and contains a metal pocket for storing prints. A removable mounting panel is for mounting electrical equipment.



Cover clamps to box eliminating holes through door.

Hoffman Engineering Corp.
Anoka, Minnesota
Circle 140 on Reader Service Card

DINOSAURS WERE SISSIES

THIS AUTO FLOOR TYPE Forging Manipulator handles 6-ton carbon steel forgings as if they were playthings. And that's only natural, for Salem-Brosius, Inc., of Pittsburgh, engineered and built the manipulator to do a specific job . . . and powered it with a Hele-Shaw pump and a Hele-Shaw hydraulic motor. Salem-Brosius has had many years' experience with Hele-Shaws and thoroughly knows their outstanding efficiency and economy.

Hele-Shaw pump is a radial-piston variable displacement fluid power generator for pressures to 3000 p.s.i. Discharge can be varied from zero to maximum, and can be reversed instantly or gradually.

When ordering variable displacement hydraulically-operated equipment, specify Hele-Shaw for top dependability. Write for full information. Or, if you need a pump for constant displacement from 3 to 100 g.p.m., ask about the AE Hydramite. American Engineering Company, 2530 Aramingo Ave., Philadelphia 25, Penna.

12,000 lb. capacity Forging Manipulator at Canadian Foundry & Forge Co., Welland, Ontario. Hele-Shaw Pumps were furnished by Benj. Lassman & Son, Glenshaw, Pa.

AE

AMERICAN ENGINEERING COMPANY
PHILADELPHIA 25, PENNA.
CANADIAN SUBSIDIARIES: Affiliated Engineering Corporations, Ltd., Montreal 16, P. Q. Bawden Industries Ltd., Toronto 3, Ont.
AE Products are: Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Head Hoists, Lo-Head Car Pullers, Taylor, Perfect Spread and Vibro-Grate Stokers.

DIAPHRAGM VALVE
. . . from Koroseal

Design: Valve works like a simple pinch clamp and is closed by pressing a flexible diaphragm against the raised bottom which is curved to fit the diaphragm. When fully closed, the diaphragm is seated under pressure providing a cushioned, leak-proof seal. No packing is required because diaphragm seals off valve stem and working parts from the fluid. This also eliminates leakage or waste of fluid.

Applications: Valve is recommended for handling fluids at temperatures to 150°F and pressures to 150 psi. Available in ½, ¾, 1, 1¼, 1½, and 2-in. sizes.

B. F. Goodrich Co.
Industrial Products Div.
Akron, Ohio

Circle 141 on Reader Service Card

FILTERS
. . . with 1 to 24 cartridges

Features: Six different types of cartridge refills may be used interchangeably, and each cartridge does a specialized filtering job depending on type of oil, flow rate, kind and degree of contamination, and

other variable factors. Units are suitable for individual machines or central systems.

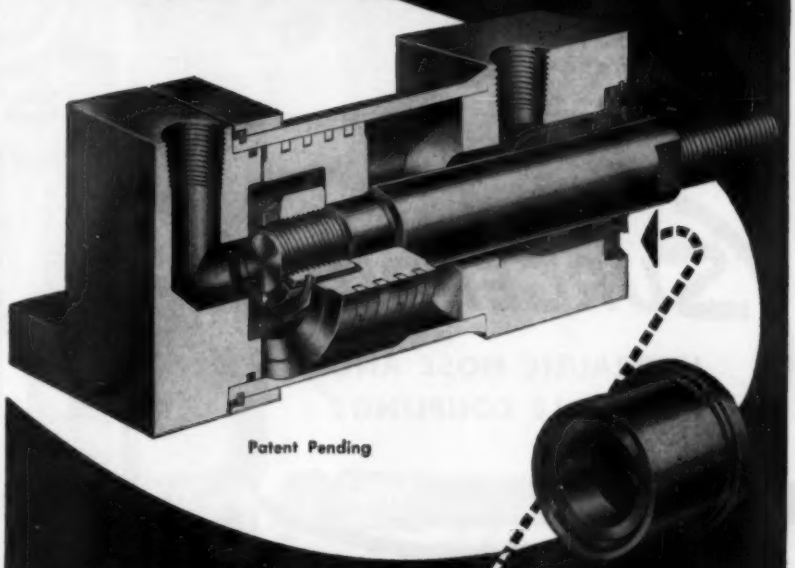
Design: Covers are fastened by swing bolts which can be loosened quickly for fast cartridge replacement. Cartridges are sealed by a removable pressure plate which locks cartridges firmly in position.

Filtration Div.
Houdaille-Hershey of Ind., Inc.
Lebanon, Indiana

Circle 142 on Reader Service Card

Continued on next page

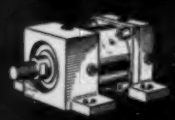
High Pressure HYDRAULIC CYLINDERS



Patent Pending

Cut downtime with "quick-change" rod packing cartridge

- 2,000 P.S.I.
- I. I. C. STANDARDS
- COMPACT DESIGN
- OPTIONAL ROD SIZES
- ALL-STEEL CONSTRUCTION
- 11 TYPES OF MOUNTINGS
- 11 BORE SIZES—1½" TO 8"
- UP-TO-DATE ENGINEERING



The S-P "quick-change" packing cartridge is easily removed for servicing seal or wiper. *Cuts downtime . . . speeds production.* S-P Hydraulic Cylinders have *every* modern design feature. Representatives in principal cities. Prompt deliveries. Send for Catalog 104. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.

THE S-P MFG. CORP. — Cleveland
A Bassett Company
PRECISION PRODUCTS SINCE 1916
AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES AND ACCESSORIES

Circle 86 on Reader Service Card

New Products / continued

THREADLESS SUBPLATE
. . . for gasket-mounted valves

Design: Subplate eliminates pipe threads in both body of valve and in subplates. Assembly consists of three elements: inserts, lockplate, and baseplate. The insert combines the sealing face for the O-ring, fluid passage through the subplate, and the tube fitting connector body. This eliminates leaks due to the porosity of the baseplate. The lockplate locks the inserts against rotation and provides the valve mounting surface flush with the gasket sealing faces on the inserts. The baseplates serve as the valve mounting pad and the bracket to hold and position the inserts.

Petch Manufacturing Co.
Detroit, Michigan

Circle 143 on Reader Service Card

JOY
SURGEPRUF
HYDRAULIC HOSE AND
RE-USABLE COUPLINGS

3 Big Advantages for Your Hydraulic Assemblies

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies —and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

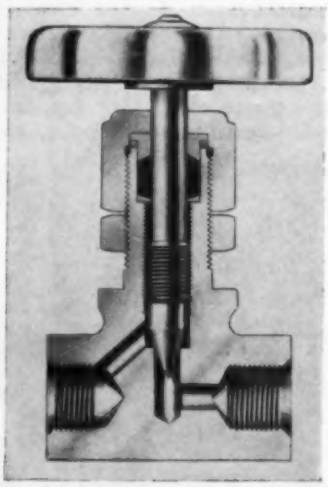
Get complete data on Surgepruf:
WRITE FOR BULLETIN H-100b
Consult a Joy Engineer

JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

W&D H5514

NEEDLE VALVE
. . . for 10,000 psi service

Features: A T-shaped stainless steel forging permits combination of body and stem guide. No welds are needed and body cannot leak or come apart. Valve is proof tested at 25,000 psi. Uses are gage and instrument service, test panels, hydraulic service, orifice meters, and test sampling.



Construction: The semi-needle stem is hardened stainless steel for long wear and non-corrosive service. It has fine, 40-pitch micrometer threading for metering and ease of turning. A locknut for convenience in panel mounting is optional. Packing of graphited asbestos or Teflon can be selected.

Specifications: Made with female pipe thread connections, sizes ⅛, ¼, ⅜, and ½-in.

Republic Manufacturing Co.
Cleveland, Ohio

Circle 144 on Reader Service Card

PRESSURE INDICATOR
. . . for remote installation

Designation: Model 168, Model 170

Features: Instruments are for telemetering pressure information from

Continued on page 102

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because you qualify!

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"CLOVER CLOSURE"

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	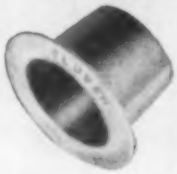	
Threaded caps for AN & SAE external threaded parts.	Tapered parts for use either as a cap or a plug.	Threaded plugs for AN & SAE internal threaded parts.

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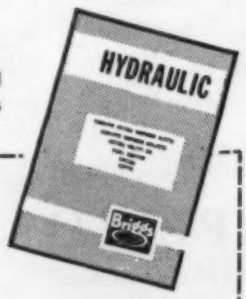
has served GISHOLT MACHINE CO. for many years and here is what they say

"We use Briggs clarifiers to purify the oil for operating all our hydraulic speed selectors. Briggs is standard on all of our ram and saddle type turret lathes. With Briggs the improved performance has more than offset the cost."

IF YOU MAKE OR USE HYDRAULIC EQUIPMENT we have a NO COST TRIAL PLAN that will interest you. Write today for complete information on

Briggs PIONEERS IN INDUSTRIAL OIL FILTRATION **HYDRAULIC OIL FILTERS** with interchangeable cartridges for mineral oils, additive oils or non-inflammable fluids —for by-pass or high flow installation.



THE BRIGGS FILTRATION COMPANY, Dept. 64
RIVER ROAD, WASHINGTON 16, D. C.
Without cost or obligation send me:
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..... Installation for up to 15 gal. capacity
..... Installation for up to 30 gal. capacity
Name ..... **Title** .....
Company .....
Address .....

New Products continued

remote or hazardous locations to a central control room up to 500 ft. distant. Sensing device includes a strain gage bridge circuit. Indicator has a built-in regulated d-c

power supply to furnish the power required for the complete system. Equipment has no moving parts other than those of the meter. No vacuum tubes, choppers, or similar components which would require renewal are used.

Taber Instrument Corp.
North Tonawanda, N. Y.
Circle 145 on Reader Service Card

HYDRAULIC VALVE . . . with oversize passages

Features: All cross-sectional areas of oil passages in the valve are equal to or greater than the area of a ¾-in. pipe for which the valve is designed. This gives a minimum of back pressure and restriction.

When operated with a fluid motor, the valve permits feathering or smooth operation of the motor from low to high speeds.

Design: Jet losses around the spool are minimized and provide anti-hydraulic lock. The valve is smooth in action from "hold" position to full oil capacity at 2000 psi. The

small size makes the valve especially suited for applications where space is limited.

Century Engineering Co.
Waukesha, Wisconsin
Circle 146 on Reader Service Card

SERVO VALVE
. . . dry solenoid type

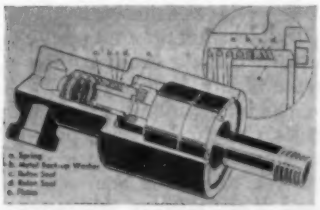
Applications: For guided missile and aircraft flight controls, radar scanner actuation, contour following machine tools, and automatic packaging equipment. Used for control systems in which the hydraulic fluid contains entrained iron or other

agents which impair torque motor operation. Especially applicable to high performance, electro-hydraulic, position servo systems. The units are designed to operate in hydraulic systems of from 1000 to 3000 psi and have equivalent time constants between .0015 and .003 seconds from input differential current to output flow. This dynamic performance makes possible control systems of high accuracy and response.

Moog Valve Co., Inc.
East Aurora, N. Y.
Circle 147 on Reader Service Card

ROTATING JOINT
. . . for high temperature

Features: Rotating joint gives perfect sealing in a range of temperatures up to 550°F. Balanced piston design and line contact of



rotating sealing surfaces provide long life with minimum servicing. Line pressure controls unnecessarily high pressures against rotating sealing surfaces and reduces friction, high torque, and wear. Unit has a self-adjusting wear take-up.

Anco Division
American Associates, Inc.
Providence, R. I.
Circle 148 on Reader Service Card

R/M VEE-FLEX®
AMERICA'S MOST COPIED PACKING

- **For steam rods, hot oil pumps, etc.**
- **For hydraulic rams, outside packed plunger pumps, accumulator rams, elevator rams, oil or water service.**
- **For food handling equipment.**

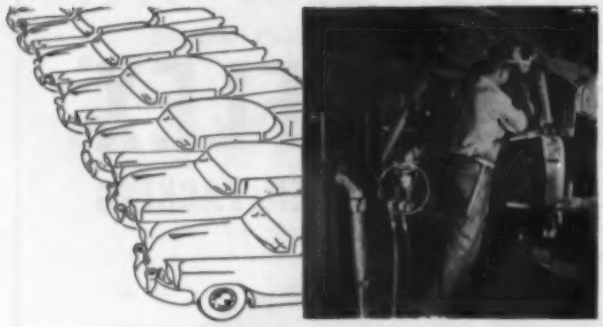
The completely homogeneous construction of R/M Vee-Flex—its deep, thorough compound penetration—enables it to take higher pressures without extruding than any other packing made. And its design makes it self-sealing, self-adjusting. The surface of each R/M Vee-Flex Ring is convexly curved where it touches the next ring. When the hydraulic pressure stroke occurs, this design produces an automatic seal laterally against the stuffing box wall and longitudinally against the next ring. For complete data, including a table of sizes, write for R/M Vee-Flex Bulletin.

R/M **PACKINGS**
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

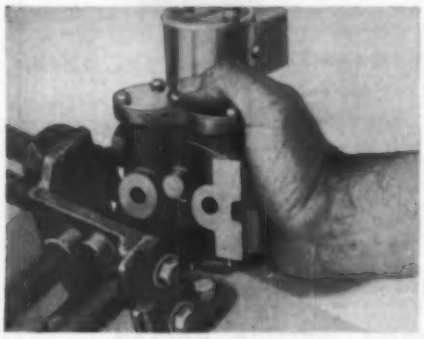
FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

Circle 81 on Reader Service Card



THEY BUILD ANOTHER CAR IN THE TIME SAVED...



How much production do *you* lose when a valve breaks down? In less than a minute you can take a Crescent® sub-base mounted four-way air valve from the line and be back in service with a new one.

But that is not the whole story. Crescent® valves are accepted on production line equipment in major automotive plants, that means they have to perform a minimum of 10 million cycles without service or breakdown.

If you are using air valves in your plant and they are not Crescent® valves, you are paying too much for them—in lost production.

Write for the informative free literature on standard and sub-base mounted four-way air valves (to 150 P.S.I.). Also available with explosion-proof solenoid housing.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Useful Literature / continued

LIQUID LEVEL GAGES . . . for indicating, recording, controlling, and telemetering are described in Bulletin L701 released by The Bristol Co. The bulletin shows float-type, pressure-type, differential pressure type, and bubbler type liquid and water level gages in strip and round chart models. Air or electric controllers are available in several models. Engineering data and installation information on liquid level telemetering and remote control is also included.

Circle 182 on Reader Service Card

REMOTE CONTROL SWITCH . . . Automatic Switch Co. has released Publication No. 568 explaining two new features available on their remote control switch. One of the features is a contact hood to shield the contacts. The hood covers the contacts behind the handle and insures complete safety to the operator. The second feature is a reduced width which permits better mounting on switchboard applications. The reduced width switches are available in current ratings from 30 to 200 amperes.

Circle 183 on Reader Service Card

AIR CYLINDER . . . with built-in cartridge valve and speed control is featured in Bulletin 125 by Carter Controls, Inc. The unit which is suitable for pressures from 5 to 200 psi is furnished in all standard bore sizes. The cylinder permits solenoid or poppet control, attached or remote. Piping costs are reduced because only a single pipe connection to the valve is required. The unit has integral speed throttles of balanced type and gives smooth hydraulic-like action to the air cylinder.

Circle 184 on Reader Service Card

AIRCRAFT EQUIPMENT . . . A new brochure has been released by Gladden Products Corp. The brochure contains information concerning a wide variety of units used in the aircraft field. Specifications and characteristics of components are included.

Circle 185 on Reader Service Card

NYLON TUBING . . . Flexible nylon pressure tubing is described in a new product bulletin issued by The Polymer Corp. Uses for the tubing, include air lines, and hydraulic lines. Complete information is provided on the material's advantages, characteristics and properties. The tubing is recommended for pneumatic instruments and control, valves, pneumatic equipment and tools, and pumps and water systems. Although continuous service lowers the burst strength of the tubing, for high-pressure service, overbraids provide the necessary strength.

Circle 186 on Reader Service Card

FLOW CONTROL VALVE . . . of new design is presented by Hays Manufacturing Co. in their Folder No. 231. Of simple construction, the valve maintains one set rate of fluid flow regardless of variable inlet pressures. The valve has only one moving part which

READER SERVICE CARD

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FIRST CLASS
PERMIT No. 8066
SEC. 34.9 P. L. & R.
CLEVELAND, OHIO

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Name _____ Position _____

Company _____ Kind of Business _____

Street _____

City _____ Zone ____ State _____

PLEASE SEND ME ADDITIONAL INFORMATION AND LITERATURE ON ITEMS CIRCLED BELOW.

1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291	308	325
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

READER SERVICE CARD

new | IDEAS • FACTS • CATALOGS
PRODUCT INFORMATION

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4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

is a rubber diaphragm that flexes with pressure changes. A fixed rate of flow is assured as the flow is regulated in direct proportion to the inlet pressures exerted against the diaphragm. The folder shows construction of the valve and includes a chart showing the consistency of flow as pressure is varied from 0 to 150 psi. Flow rates are held to 10% for hot or cold water.

Circle 187 on Reader Service Card

INSTRUMENTS . . . manufactured by Minneapolis-Honeywell Regulator Co. are outlined in their Composite Catalog 5002. References are made to more complete catalogs on each equipment. Included is an air cylinder for pressures from 0 to 15 psi. These cylinders are intended for accurate positioning of devices and contain a composition bellows. Equipped with adjustments which provide full flexibility for various applications, the cylinder provides positive positioning.

Circle 188 on Reader Service Card

OIL FILTERS . . . for portable use are introduced in Bulletin 316 published by The Hilliard Corp. The bulletin includes information and references concerning combination portable oil filters and oil reclaimer units. The four-page bulletin discusses oil maintenance ability of the filters and lists their uses. References for specific data are included.

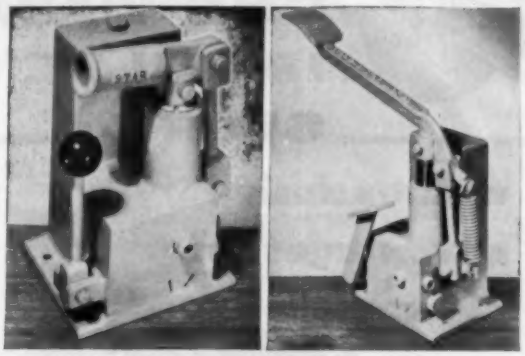
Circle 189 on Reader Service Card

BOOSTERS . . . for air pressures to 150 psi and hydraulic pressures to 18,850 psi are outlined in

Continued on next page

Circle 96 on Reader Service Card

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



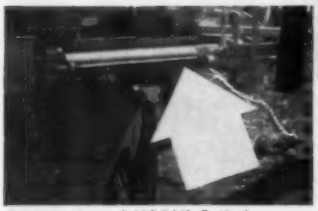
- **HAND OR FOOT OPERATED WITH SINGLE LEVER OR PEDAL**
  Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger —3 models (½"-⅞") (½"-1¼") (½"-1½")

Representative areas available

Star Jack Co., Inc.
420 Lexington Ave., New York 17
PLANT: RIVER GROVE, ILLINOIS

PINEAPPLE HARVESTER
USES 5 NOPAK HYDRAULIC CYLINDERS

Arrows show location of 2 NOPAK Cylinders.



Close-up view of NOPAK Cylinder which rotates superstructure of harvester 210°.

NOPAK 4" x 48" cylinder positions conveyor boom to suit field conditions.

*With the cooperation of NOPAK Hawaiian representative, Chapsen Bros. Ltd., Honolulu.

Unique Machine Developed in Hawaii by Libby, McNeil & Libby Engineers*

The pineapple harvester pictured is the result of continuing research and experimentation by the mechanical engineering staff of Libby, McNeil and Libby, in striving for better methods, more efficient machines, and lower costs in all operations from field and farm to packing and labeling.

While space does not permit a detailed description of their functions . . . 5 NOPAK Hydraulic Cylinders are used in this self-contained harvester to provide the power for various movements essential to its successful operation.

Power for machine motions . . . pulling, pushing, lifting, feeding, retracting . . . are provided in all kinds of machinery and equipment by NOPAK Cylinders . . . controlled by NOPAK Operating Valves. For a wide range of interesting installations, write for the NOPAK APPLICATION MANUAL.

GALLAND-HENNING NOPAK DIVISION
2743 SOUTH 31ST STREET • MILWAUKEE 46, WISCONSIN

Refer to Classified Section of your Telephone Directory for name of nearest NOPAK Representative.

Ask for NOPAK Cylinder Catalog 101 or Bulletin SW-3.

NOPAK
® VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

A 8388-½HA

ELECTRO SNAP

ONE-WAY IMPULSE SWITCH

with exclusive advantages for automation

$10.50
plus $.25 shipping charge

Model ES4-KM2
½ actual size

ELIMINATES INTERLOCKING SWITCHES AND COMPLICATED ACTUATING DOGS

Ideal for pulsing solenoid valves on air-hydraulic controls, sequencing circuits, etc., because it allows other controls to reverse or operate the same circuit. Switch sends a short electrical impulse and then switches itself out of the circuit.

GIVES MORE DEPENDABLE CONTROL

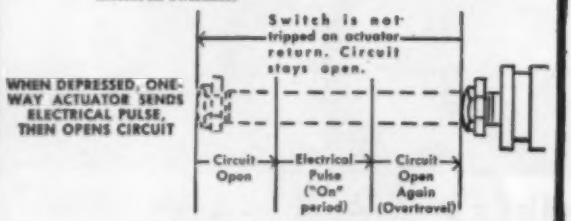
Switch replaces timers, relays, and troublesome one-way dogs to simplify circuits — cuts chances for failure. No delicate adjustments.

LOWERS COST OF CONTROL CIRCUITS

Impulse switch costs less than complicated control devices it replaces. Fewer switches are required for sequencing. Simple mounting.

SPEEDS UP AUTOMATIC OPERATION

Automatic machines can run faster because cycles can be more closely sequenced. There's no delay due to timer tolerances or extra machine motions to actuate interlock switches.


Switch is not tripped on actuator return. Circuit stays open.
WHEN DEPRESSED, ONE-WAY ACTUATOR SENDS ELECTRICAL PULSE, THEN OPENS CIRCUIT
Circuit Open
Electrical Pulse ("On" period)
Circuit Open Again (Overtravel)

SPECIFICATIONS

UL rated at 10 amps/125v AC Movement Dif. 0.020"
Operating Force 3½ lbs.

Model No.	Overtravel	"On" Period (inches of actuator travel)
ES4-KM1	3/8"	1/16"
ES4-KM2	5/16"	1/8"
ES4-KM3	1/4"	3/16"
ES4-KM6	1/16"	3/8"

TRY ON YOUR CONTROL JOB — ORDER NOW

Send Your Standard Purchase Order
Specify Model Wanted—Discounts on Quantity Purchases
Data Sheet ESF-6

ELECTRO SNAP

ELECTRO-SNAP SWITCH & MFG. COMPANY
4220 West Lake Street, Chicago 24, Illinois

Useful Literature continued

releases from Powermatic Sales Co. The material indicates ratios of air to hydraulic pressures for various models with industrial applications of the units. These applications include test stands, pipe benders, and gear pullers. The differential area principle is used for controlling the air input and consequently the hydraulic pressure. The air and hydraulic pressures can be equalized by regulating the air input, so that the booster works only when additional hydraulic pressure is required.

Circle 190 on Reader Service Card

AIR CHUCK . . . A new air chuck is announced in an information sheet from Wright Tool Inc. The chuck is for precision use at high speed. It is highly versatile and double acting for internal and external holding. The unit fits all standard spindles without need for bulky adapter plates. The complete kit contains air hoses and fittings, chuck, power cylinder, and control unit containing moisture trap, pressure regulator and gage, lubricator and four-way valve.

Circle 191 on Reader Service Card

VALVES, TIMER . . . manufactured by Emmet Machine & Manufacturing, Inc. are described in information sheets available from the company. Included are two 300-psi, air-operated valves, for either diaphragm or cylinder operation. Because of the angular construction of these valves, pressure drop is reduced to approximately 20% that of other valves. A 3000-psi, two-pressure valve is also described. The valve using air and hydraulic pressures regulates low-pressure approach, and high-pressure clamp for press and clamping circuits. The timer is a self-contained timing control which includes a solenoid valve, signal light, pushbutton station, and timer mounted in a rugged case with internal exhaust to resist dirt infiltration.

Circle 192 on Reader Service Card

MEASUREMENT GAGE . . . for O-ring grooves is described in a brochure from Mueller Laboratory. The basic unit which comes in three different sets can be set with micrometers, standard blocks, or ring gages. Operated with a pistol grip, the gage has a dial accurate to .0005 in. The set for measuring O-ring grooves can be used for O-ring types from —3 to —31. Three sets of tips which are hard chromed are provided.

Circle 193 on Reader Service Card

PROTECTIVE CAPS . . . for protection of pipe threads, tubing ends, and for sealing and other applications are specified in Ray A. Scharer & Co. Catalog 55-1. The caps and plugs are supplied in various shapes and sizes to fit standard pipe and tubing. Special sizes can be designed and produced to fit individual requirements where standard sizes cannot be used. The caps and plugs have an elasticity which permits fast installation, and friction fits assure permanency until removed.

Circle 205 on Reader Service Card

Circle 35 on Reader Service Card

MARKING TAPE . . . is the subject of a catalog offered by North Shore Nameplate Inc. The tape is for use in marking pipe or similar equipment and can be used at temperatures to 400°F. The tape is not affected by cold, humidity, or vibration. Furnished on white fibre cards, the tape is recommended for container signs, safety signs, fluid lines and conduits, maintenance operations, and many other uses.

Circle 194 on Reader Service Card

RUBBER PRODUCTS . . . are the subject of Catalog No. 53A published by Acushnet Process Co. The catalog presents the company's plant facilities, range of products, and includes a data section giving physical characteristics of natural and synthetic rubber materials. A glossary of rubber terms is presented with a description of various methods of rubber molding. In addition to various other products, the company manufactures O-rings, boots, and rubber-to-metal bonded parts. The latter combine the best properties of metal and rubber to obtain strength, resiliency, and vibration absorbtion.

Circle 195 on Reader Service Card

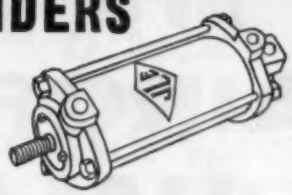
AIR TURBINE DRIVES . . . manufactured by Stratos Div. Fairchild Engine & Airplane Corp. are the subject of a brochure which presents a general description of their use and information on three different models. In addition charts are included showing bleed air requirements for typical air-turbine drives. The units are designed for 2 to 100 hp and operate on air bled from the compressor of turbo-jet or turbo-prop engines. The turbines are recommended

Continued on next page

Circle 36 on Reader Service Card

JLE **CYLINDERS**

Quality without compromise . . .



- The JLE "Work Horse" Cylinder line for air pressures to 110 psi, 250 psi hydraulic. Designed for our own exacting applications on wire machinery, is rugged and dependable. Available in four standard mountings, both cushioned and non-cushioned, in bore sizes 1½ to 10 in.
- The new JLE Square Cylinders for air and low pressure hydraulic service, are available in interchangeable stock mountings, fixed, automatic or adjustable cushions in bore sizes from 1½ to 16 inches.
- Engineering service available for all fluid power problems. Write us or contact your nearest authorized distributor.

Send for new JLE Cylinder Catalog HP 106

JLE **JAMES L. ENTWISTLE CO.**

1475 Elmwood Ave. • Cranston (Prov. 7), R.I.

REPUBLIC "LO-TORQ" SELECTOR VALVE

0-6000 psi SERVICE with LOW TURNING TORQUE

Exceptionally low turning torque is obtained by "floating" the valving disk in the service fluid, thereby balancing the pressure and eliminating thrust bearings . . . a sound application of the hydraulic engineering principle that fluids under pressure exert force equally in all directions.

Sealing rings on both sides of the selector disk eliminate leakage at all times whether pressure is forward, back, or off entirely.

For air and gas service, 0-2000 and 0-4000 psi; for fuel, hydraulic oil, petroleum, and water service, sizes ⅛" to 1", 0-3000 and 0-6000 psi. 2, 3, and 4-way.

Write for catalog no. 454 for complete information.

Distributors in principal cities from coast to coast.

- 0-6000 psi service
- Low turning torque
- Panel mounting
- Semi-steel, bronze, aluminum alloy
- No leakage at any time
- 3 types of porlings

RM

REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

You get AIRCRAFT QUALITY

To preserve their quality and shape, and permit easy installation, 50 Fluoroflex-T spiral rings come snugly seated on supporting mandrel, secured with rubber rings at each end, and in a "telescopic" container.

Millions in use verify high performance

Fluoroflex-T anti extrusion rings are produced from virgin Teflon® powder under a strict quality control and inspection system approved by the USAF under MIL-Q-5923. Millions of them are today contributing to more reliable functioning of "0" ring seals in both commercial and military aircraft hydraulic systems.

Fluoroflex-T is processed so as to relieve internal stress without creating porosity. This means maximum dimensional stability and tensile strength . . . which in turn assure optimum performance and service life.

With properties conforming to AMS-3651, Fluoroflex-T rings reduce friction, are entirely unaffected by any hydraulic fluid both physically and chemically, and withstand up to 500°F, depending upon operating pressures.

Complete range of sizes available for use with AN6227 and AN6230 series "0" rings. Send for data.

®Fluoroflex is a Resistoflex registered trade mark for products from fluorocarbon resins. Teflon is the DuPont registered trade mark for its tetrafluoroethylene resin.

RESISTOFLEX

CORPORATION

Belleville 9, N. J. • Western Division: Burbank, Calif.

Useful Literature

continued

for driving hydraulic pumps and air compressors as well as other aircraft equipment requiring a constant speed drive. Constant speed control is achieved through modulation of the air supply. A butterfly valve with an extremely rapid response controls the flow. This valve is actuated by a sensitive pneumatic control system which is integral with the unit.

Circle 196 on Reader Service Card

CHECK VALVES . . . manufactured by Klepner Products Co. are specified in a brochure offered by the company. The valves incorporate a flexible seal for pressure cushioning. This insures positive sealing, positive pressure at low working pressure, low pressure drop, and freedom from vibration and chatter. Various mounting dimensions and arrangements are specified, and the seal action of the valve is illustrated.

Circle 197 on Reader Service Card

PRESSURE GAGES . . . for pressures up to 10,000 psi are included in General Catalog 1 by the Fischer & Porter Co. The pressure gages may incorporate open frame bellows, opposed bellows, pneumatic receiver bellows, helical bourdon, or liquid-filled helical bourdon. Pressure compensating systems and alarm accessories are easily adapted to the basic units. Also included in the catalog are instruments for measurement of liquid level, temperature, density, and viscosity.

Circle 198 on Reader Service Card

D-C CONTACTORS . . . and control relays for heavy industrial applications are described in Bulletin 14B8171A released by Allis-Chalmers. The units are available with either single or double poles and normally-open or normally-closed contacts and mechanical interlocks. The contactors are designed for interruption of currents from 25 to 600 amperes, 600 volts maximum. Design of the units ensures quick arc extinction and minimizes contact deterioration.

Circle 199 on Reader Service Card

FLOW METERS . . . combining precision with simplicity are described in Bulletin 115 from Brooks Rotameter Co. The basic line offers wide flexibility, and various units for different applications are shown. Primary feature of the flow meter is the dowel-pin, side-plate construction and safety glass shielding. Simplicity of mounting is illustrated and various float designs are shown. The complete flow-measuring line of the company is also reviewed.

Circle 200 on Reader Service Card

CONTROL SWITCHES . . . including pushbutton control, limit switches, miniature snap switches, and rotary switches are presented in a brochure from Micro Switch Div. of Minneapolis-Honeywell Regulator Co. Typical mounting dimensions, characteristics, and applications for the devices are presented. For further information about any type of control shown in the brochure, additional catalogs are listed.

Circle 201 on Reader Service Card

SEALING COMPOUND . . . of Teflon is described in Bulletin T-2 presented by The Gilbreth Co. The pipe thread sealing compound is chemically and biologically inert and can be used continuously from —150° F to 500° F. The compound seals threads completely without cementing, and the equipment can be readily dismantled after intensive use.

Circle 202 on Reader Service Card

RECIPROCATING PISTON PUMP . . . with a 2½-in. stroke is presented in Data Sheet 63 of Aldrich Pump Co. This small pump is designed for installations where larger pumps were previously used. Plunger sizes range from 11/32-in to 2½-in with displacements from 2.08 gpm to 109.6 gpm. The pressure range is from 390 psi to 20,700 psi. One section of the material is devoted to applications including metalworking, plastic molding and general industrial use. Other sections describe the parts such as crankshaft, frame, connecting rods, lubrication system, plungers, and valves.

Circle 203 on Reader Service Card

AIR CYLINDERS . . . Miller Fluid Power Company's new Bulletin A-105K gives complete, up-to-date design, construction, engineering and mounting and dimensional data on their 200-psi, heavy duty air cylinders from 1½-in through 14-in bores and strokes through 22 ft. This bulletin supersedes Bulletin A-105G and includes the new Model 77, Model 83 modified for additional mounting strength, and further data on high temperature operation.

Circle 204 on Reader Service Card

Circle 44 on Reader Service Card

Gresen

HYDRAULIC CONTROL VALVE

(Directional)

Model S.P.

- For Single or Double Acting Cylinders
- Pressures to 1500 PSI
- Built-in Adjustable Relief
- Ball Checks Openings

½" cylinder ports ¾" inlet and outlet

Write for literature

GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. A-55 Minneapolis 11, Minn.

Air and Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 60" DIAMETER • STROKES OF 50 FT. AND LONGER

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

18½" Bore
13" Rod
3000 PSI

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN MACHINE CO., INC.

326 West 2nd Street—Salem, Ohio

Post Scripts of Industry

News about people, manufacturers and sales organizations

Harry W. McCracken
The Stanley M. Procter Co.

H. M. Kirby
A. W. Cash Company

James F. Healey
The Aro Equipment Corp.

The Stanley M. Proctor Company, Cleveland, has named **Harry W. McCracken** as district sales manager. McCracken, whose experience in the field of hydraulics and pneumatics covers a period of over 20 years, was formerly district sales manager for Westinghouse Air Brake Company.

A. W. Cash Company has appointed **H. M. Kirby** to the newly created position, director of marketing. A graduate of Purdue University, he was previously connected with the American District Steam Company.

Industrial Piping Supply Corp., is the new tube fitting distributor for the Parker Appliance Company in Bessemer, Alabama. The company will cover Birmingham, Mobile, Decatur, Sheffield, Huntsville and other points in Alabama, as well as cities in northwest Florida.

John M. Wilson has been appointed chief engineer of the development and design division of the engineering department of Minneapolis-Honeywell's **Brown Instrument Division.**

James F. Healey has joined the technical staff of **The Aro Equipment Corporation.** He will be responsible for a new program covering precision instruments applicable to guided missiles and pilotless aircraft.

Ray Gayner, assistant to the manufacturing vice president of Northrop Aircraft, Inc., has assumed duties to coordinate all manufacturing operations for the company.

The American Thermometer Division of **Robertshaw-Fulton Controls Company** has been renamed the **American Controls Division.**

Howard I. Dickson has been promoted to senior sales representative for the **Chiksan Company.** Joining the organization in 1949, as an order clerk, Dickson rose rapidly as salesman, and sales office manager to his present position.

Ritter Engineering Co., Pittsburgh, has been named a distributor for tube and pipe fittings of the Parker Appliance Co. The company, headed by **Wayne G. Ritter** will cover western Pennsylvania and upper West Virginia.

E. M. Detwiler was promoted to works manager of **Lake Erie Engineering Corp.** He was general superintendent since 1953. Also filled were three other newly created offices; **H. Bennett** as sales manager, **Robert J. Fuller** as assistant treasurer and **Robert W. Gerhardt** as sales project engineer for the company's line of

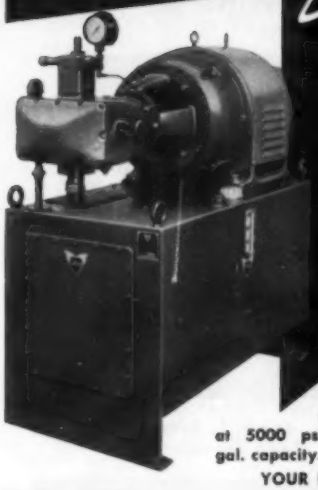
Continued on page 112

Circle 22 on Reader Service Card

MORE POWER TO YOU ... from CENTURY!

CUSTOM HYDRAULIC POWER UNITS

Designed **RIGHT!**
Built **RIGHT!**
Priced **RIGHT!**



For example— This Century designed and built Power Unit. 50 H. P. motor drives variable delivery pump with maximum output of 20 gpm at 5000 psi. Century reservoir is 125 gal. capacity.

YOUR INQUIRIES ARE INVITED

CENTURY HYDRAULICS, INC.
8866 GREENFIELD — DETROIT 28, MICHIGAN

Circle 95 on Reader Service Card

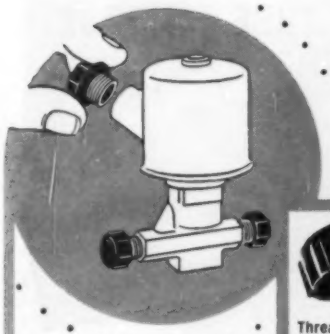
specify standard

UNBRAKO

Dryseal-Thread Pressure Plugs

Use them in place of ordinary pipe plugs, or wherever liquids and gases must be contained under pressure. UNBRAKOs seal without compound. They are made of the same high strength alloy steels, have fully formed threads and the same internal wrenching feature as other UNBRAKO socket screws. Standard sizes—1/16" to 1 1/4"—are stocked by authorized industrial distributors. Ask your UNBRAKO supplier for Bulletin 883. Or write STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION **SPS**
JENKINTOWN PENNSYLVANIA



CUT Shipping Losses this low-cost way

S.S.WHITE PLASTIC PLUGS AND CAPS are the ideal way to protect threaded and unthreaded parts against losses due to damage, dirt, moisture and loss of fluids or lubricants. Easy to apply — easy to remove, they're a "must" during shipment, storage or maintenance.

Samples and literature on request. Write Dept. L C-1

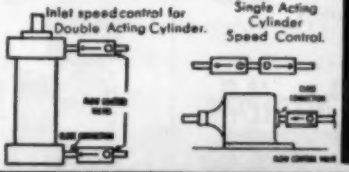
THE S.S.White PLASTICS DIVISION
DENTAL MFG. CO. 10 East 40th Street New York 16, N.Y.
Western District Office • Times Building, Long Beach, California

Get Easier, More Accurate Cylinder Speed Control with *Pneu-Trol* VALVES IN AIR OR HYDRAULIC USE

2000 and 5000 (steel) P.S.I.

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 5 female pipe sizes—1/8" to 3/4". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices—Imediate Delivery.

Write for Illustrated Circular and Price List.



Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago 51, Ill.

Circle 109 on Reader Service Card

Circle 79 on Reader Service Card

Why Specify Anything But The Best in BEARINGS · BUSHINGS WEARING PARTS

--that means

Prometl Engineered Bronze

We are at the right hand of big buyers of bearings—advising them, helping them with their problems. We'll be glad to get on the job for you, too. Discuss your bearing problems with our metallurgists, engineers, and laboratory technicians. This service will in no way obligate you. Write for free literature and service data sheets or send blueprints, conditions of operation and data for recommendations and quotations.

THE American Crucible PRODUCTS CO.

. . . bearing specialists since 1919

1303 Oberlin Avenue
Lorain, Ohio, U.S.A.

Post Scripts of Industry

continued

die casting machines. Bennett and Gerhardt were formerly associated with Hydraulic Press Manufacturing Co., and Fuller came from Colonial Radio Corp.

J. E. Rhoads & Sons, have moved their main office from Philadelphia to 2100 W. Eleventh Street, Wilmington 99, Delaware. This new office building, adjacent to their plant, will enable the company closer coordination of sales, engineering, research and production and give more efficient service.

M. J. Ross has been named manager—export trade, for both the **Quaker Rubber Corporation** and **The Watson-Stillman Company Divisions** of H. K. Porter Company, Inc. He was previously export manager for Quaker Rubber Corp.

James L. Straight has joined the public relations staff of **Lear, Incorporated.** A prominent aviation executive and publicist,

James L. Straight
Lear, Incorporated

Straight was recently associated with the California Manufacturers Association.

LENZ "O-RING" TUBE FITTINGS

ELIMINATES
FLARING,
THREADING,
WELDING,
SOLDERING

A HACKSAW AND FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. Nut fits loosely on the tube for ease of assembly. The higher the pressure the tighter the grip. LENZ FITTINGS are ideal for quick, simple, easy to assemble, leak-proof connection — for steel or copper tubing — on air and hydraulic systems.

DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

LENZ COMPANY

Box 1044-A • DAYTON 1, OHIO • ORegon 9364

Circle 5 on Reader Service Card

Circle 61 on Reader Service Card

Lincoln Supply Co., formerly located in Providence, has moved to new, enlarged quarters at 1139 Main Street, Pawtucket, R. I. This new one story structure will permit the company to display the various types of pneumatic and hydraulic equipment. Lincoln Supply has also been appointed distributor for the **Imperial Brass Manufacturing Company.** An increased sales force will cover the states of Maine, Vermont, New Hampshire, Rhode Island and Massachusetts.

Vickers Incorporated has further expanded its El Segundo Division to provide complete facilities for the design and manufacture of special hydraulic valves for airborne application. Until recently, this division was responsible for the design and production of a variety of hydraulic products, including aircraft accessories.

C. Shreve, superintendent of manufacturing (left) and E. I. Brown, chief engineer of the El Segundo Division holding two models of their pump control valve.

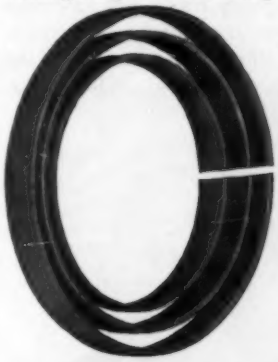
The complete aircraft portion of the facility consists of an engineering design group, an engineering laboratory and a production department. Vickers-Detroit continues as both general office for aircraft activities as well as design and development for aircraft pumps, motors and allied products. Close liaison between El Segundo and Detroit will be maintained to minimize design, development and production time for all categories of aircraft oil-hydraulic equipment.

Continued on next page

Circle 10 on Reader Service Card

WORLD'S HOTTEST JET J-57
Sets Two World Records
use AUTO-DIESEL Piston Rings!

Auto-Diesel have made quality piston rings since 1921. They have pioneered many new developments—producing rings that have made outstanding performances. The terrific speed of J-57 Jets required rings that would give unusual performance. These world record breaking Jets were equipped with Auto-Diesel Air Sealing Piston Rings made of Aircraft Stainless Steel. Regardless of how exacting your piston ring problems might be—consult Auto-Diesel Engineers, they have the experience to solve unusual ring problems. We manufacture sealing rings for actuating cylinders for Jet engines.



SAVE MONEY, *use*
AUTO-DIESEL LONG-WEARING
Piston Rings

LONG WEARING Guide Rings were badly needed in single acting hydraulic cylinders. The Engineers at Auto-Diesel solved this problem by developing a bronze ring that gives much longer service. We are in position to fill small orders quickly and at ATTRACTIVE prices. They are made from 2" up to and including 10" in diameter and in widths from ¼" to 1½".

Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES *Since* 1921"

for *SUPERIOR DESIGN*
use... Hydro-Line CYLINDERS

SERIES "J" CYLINDERS
for rugged, trouble free service

- *CARTRIDGE . . . rod-wiper, packing, bushing in one unit.*
- *RUGGED BODY . . . all steel end caps and barrel.*
- *PISTON RINGS . . . step-cut joint, sealing in both directions, long life, minimum leakage.*
- *PRESSURE . . . 2,000 psi heavy-duty . . . 3,000 psi non-shock.*
- *SIMPLICITY . . . no tie-rods . . . no retainer rings.*

Write for Bulletin No. 53

Hydro-Line *Manufacturing Co.*
5605 PIKE ROAD • ROCKFORD, ILLINOIS

Post Scripts of Industry
continued

To provide faster delivery service to West Coast customers, **Fulton Sylphon Division of Robertshaw-Fulton Controls Company** has opened a new warehouse at Lynwood, California. It replaces the company's facilities in Los Angeles. **William J. Hajek** is in charge of the operation.

John Bermingham, formerly sales representative, has been appointed western sales manager for **E. F. Houghton & Co.** He succeeds W. A. Fletcher, who died last April and managed the territory since 1941.

The Air Brake Division, Westinghouse Air Brake Company has formed a new Special Products Group to expand that division's manufacturing and marketing activities. **DeWitt L. Shelley** has been appointed manager of this group which will specialize on quality controlled manufacture. The facilities and capacities at the division's plant at Wilmerding, Pa., will be utilized.

DeWitt L. Shelley
Westinghouse Airbrake Co.

Hydro-Line Manufacturing Company, Rockford, Ill., held its first annual sales meeting on May 5 and 6 at the plant and at the Wagon Wheel Lodge. Over 20 representatives of the national distributor organization participated in the well planned two day program.

A tour of the plant was first on the agenda. At a meeting which followed, O. B. Harding, president, reviewed the history and outlined the plans of the company for the coming year. He reported that sales in the first quarter were at a rate twice that of last year's sales. John Harding, sales manager, detailed the new sales program and advertising plans. Jack L. Modrich, vice president, acted as chairman of the meeting.

The afternoon session was devoted to technical and sales procedural aspects. Joe Bos, chief engineer, covered design and construction features of Hydro-Line cylinders and went over inspection and final test procedures. Stuart Taylor, expediter, described in detail the steps in customer order procedure, including suggestions for handling special and emergency orders. Bob Peterson, shop su-

A two-position, 4-way valve for air or hydraulic fluids at pressures to 100 psi and vacuum to 25".

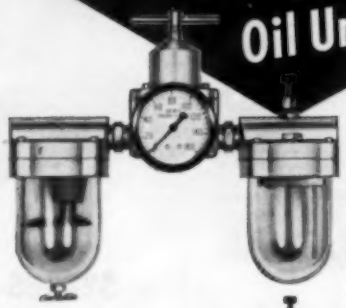
FEATURES:
Leak free operation. Low cost. Low handle torque. Low pressure drop. Easy panel mounting. Corrosion-resistant materials—bronze, aluminum. Simple maintenance—disassembly without disconnecting lines.

SPECIFICATIONS:
1. Fittings—Model S-576 for ¼" tubing port connections per AND10056. Model S-576-1 for ¼" female pipe thread port connections.
2. Weight 6 ounces.
3. Seals—standard commercial "O" rings.
4. Finish—black anodized.
5. Size: 3⅜" wide by 2⅝" deep, including handle.

For complete information, send for Bulletin 3000.

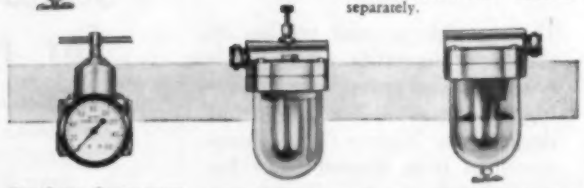
SPRAGUE *Engineering Corporation*
1144 WEST 135TH STREET, GARDENA, CALIFORNIA

AIR-MITE
FILTER—REGULATOR
Oil Unit



- Instantaneous response to demand
- Special Filter for cleaner air
- Accurate injection of pre-atomized oil

The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life Operates at pressures to 160 psi. Available in ¼", ⅜" and ½" T.P. sizes. Individual units available separately.



Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator — Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter — Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

AIR-MITE Devices, Inc.
4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

Circle 93 on Reader Service Card

Circle 4 on Reader Service Card

perintendent, discussed production methods and outlined the advantages of new machines and tooling now in use.

At the dinner meeting Paul L. Reed, executive editor, APPLIED HYDRAULICS, spoke on the relationships of the fluid power manufacturer and his distributors.

A tour of the Greenlee Brothers plant was arranged on Friday morning, where cylinders on transfer machines were inspected. A new design hydraulic cylinder operated pole hoist and hole auger, now a standard road unit of

Jack L. Modrich
Hydro-Line Manufacturing Co.

A.T. & T., was demonstrated at the plant. At a luncheon, Dave Crew, assistant to the president, Sundstrand Machine Tool Co., outlined the Machinery Replacement Programs sponsored by the Rockford Group of Machine tool manufacturers.

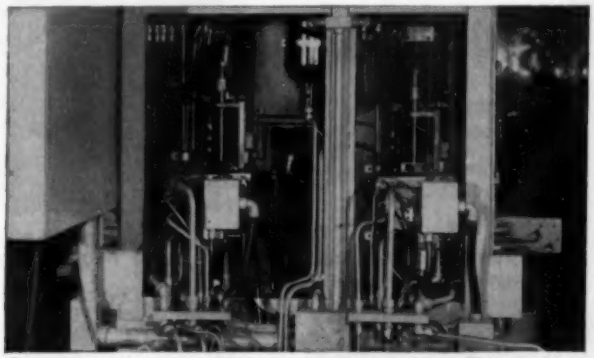
The final afternoon program was devoted to individual discussions of distributors' field problems.

Ira Weston (left), president of **Weston Hydraulics Ltd,** North Hollywood, received the Perpetual Sweepstakes Trophy from the vice president of the Greater Los Angeles Safety Council, on behalf of the company, for the best safety record of 1954 in Southern California.

Aeroquip Corporation has purchased a newly completed plant in Toronto, Canada. The new facilities contain 30,000 square feet of factory area and offices for their recently formed Canadian subsidiary, **Aeroquip (Canada) Ltd.**

R. P. Adams Co., Inc., has appointed **R. T. Nelson** as their eastern regional representative. With offices in Pittsburgh, Pa., Nelson will cover the eastern part of the country including the states of Michigan, Ohio, Kentucky, Tennessee, Georgia and Florida. Also announced was the appointment of **W. G. Barstow Company,** Minneapolis, Minn., as sales representatives for Minnesota and Iowa.

James F. Magin, vice president and director of the **Square D. Company,** has been appointed general manager of the company's Industrial Controller Division. Magin joined Square D in 1946 and was elected a vice president in 1953.



Rear view of Micromatic Hydrohoner, showing piping. This machine, a combination of two double-spindle honers, automatically finishes 500 automotive connecting rods an hour to a tolerance of a few tenths of a thousandth.

Easy-to-Form "SUPERIOR" Hydraulic Tubing Resists Vibration and Pressure Surges in Microhoning Production Equipment

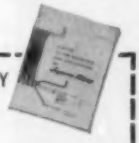
Material used: SUPERIOR carbon steel hydraulic tubing, ½" OD x .049" wall and 5/16" OD x .035" wall.

Problem solved: The problem, the makers say, is threefold: ease of forming, ease of assembly, and ability to resist vibration and pressure surges of 100 to 500 psi without leakage. SUPERIOR tubing is the only tubing they have found that fills the bill. The non-aging hydraulic quality permitted the customer to keep an adequate supply on hand.

The process: Bores .006 in. to 40 ft. in length are regularly honed with Micromatic equipment. The Microhoning process is a method of automatically and rapidly removing stock from cylindrical surfaces.

Microhoning produces geometrically straight and round holes, with uniform surface finish, and without generating localized heat.

Perhaps SUPERIOR can solve your problem, too. Use the coupon for free samples and literature. On the West Coast, write Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif.



SUPERIOR TUBE COMPANY
2030 Germantown Ave.
Norristown, Pa.

☐ Send me a free copy of Bulletin 40—A Guide to the Selection and Application of Superior Tubing.

☐ Send me a free sample of.....(name of alloy) tubing;....." OD;....." wall; to be used for .....

Name .....
Title .....
Company .....
Street .....
City .....Zone.....State.....

• Since 1926 • In the application, design and manufacture—pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary
Oil Pumps
•
Vacuum
Powered
Transmission
and
Low
Pressure
Air Service
•
Air
and
Liquid
Filters
•

What's your problem?

- higher pumping speeds?
- tolerance of particle-laden liquids?
- peak suction for primary pumps?

the Kraissl-50 Roller Pump

is unmatched for dependable performance on every one of those counts.

Bulletin A-1330 has full data . . . write for it. The roller-rotor design easily handles particles that would jam more tightly-fitted mechanisms—reduces cavitation, allowing higher speed operation*—develops high suction characteristics.

*Roller mechanisms permit higher speeds with any oil than most displacement designs.

KRAISSL CO

385 Williams Ave., Hackensack, N.J.

Post Scripts of Industry

continued

Edward M. Greer, president, **Greer Hydraulics, Inc.**, has announced the election of **G. Lawton Johnson** to the board of directors. Johnson, a graduate of the College of Engineering of the University of Michigan, joined the company in 1953 as vice president. He now directs the operation of the wholly-owned subsidiary, Greer Marine Corporation, as well as those of the company's products division.

G. Lawton Johnson
Greer Hydraulics, Inc.

Ajax Flexible Coupling Co., Inc., announced the election of the following officers at the annual corporation's meeting: Wayne Belden, president; Charles W. Belden, vice president; Harley E. Northrop, treasurer; and Robert G. Cady, secretary.

Howell Electric Motors Company has recently strengthened its sale-engineering organization in five of its key marketing areas. A new district office has been opened in Saginaw, Michigan, headed by **R. W. Hogan,** formerly a member of the company's sales engi-

What he needs is a

STAFFA HYDRAULIC RAM!

Staffa Rams are available in four standard ranges: high and low pressure solid, high pressure hollow and tubby rams. Loads from 1 to 150 tons. Pressures up to 5,000 p.s.i., strokes up to 36". Higher pressure and larger stroke rams are made specially.

For rams, pumps and all other hydraulic equipment write to Chamberlain Industries Ltd., Staffa Works, Staffa Road, Leyton, London, E.10.

For pulling, pushing, lifting, pressing, clamping, bending or spreading.

CHAMBERLAIN INDUSTRIES LTD.

Staffa Works, Staffa Road, Leyton, London, E.10, England.
Telephone: LEYtonstone 3678.

Circle 58 on Reader Service Card

Circle 24 on Reader Service Card

William G. Patriquin
The Gabriel Co.

William H. Kieber
The Gabriel Co.

neering staff in Detroit. **Paul J. Moore** represents the firm in the New York City—New Jersey area, **Lynn F. Hummel** in the Florida territory, with headquarters in Orlando, **John P. Logan** will cover Southern California and Arizona from his Los Angeles offices, and **Tate & Scanlon** will handle the Howell line in Northern Texas with headquarters in Dallas.

William H. Kiber was promoted from assistant chief engineer to the newly created position of engineering and sales consultant of **The Gabriel Company.** Associated with the firm since 1944, Kieber has had extensive experience in the application of damping devices. **William G. Patriquin,** former research engineer has been appointed to succeed Kieber as assistant chief engineer.

J. Neill Armstrong, distributor of hydraulic and pneumatic components has incorporated his business, to be known as **J. Neill Armstrong, Inc.,** with the main office located in Westmont, N. J. A New York branch office has also been opened with **Kenneth S. Lester** as manager.

THE MARKET PLACE

Classified Advertising Rates: Cost of Position Wanted Ads is $10.00 for the first inch, each additional line 90 cents. Cost of all other classified ads is $20.00 for the first inch and $15.00 for each additional inch or fraction thereof. Rates for Display Ads in this section will be sent on request.

WANTED—BUSINESS ASSOCIATE

Rapidly growing fluid power sales organization in Denver wants top hydraulic pneumatic sales engineer. Part of company available to right man. Box 6155 APPLIED HYDRAULICS.

NEW!

Speedy

1 TON
Heavy Duty
AIR PRESS
No. 80
only $85

★ Heavy grey iron casting, accurately machined surfaces.

★ Power factor—15 times air line pressure of 5 to 150 lbs.

★ Throat clearance to center of 18" diam. circle.

★ Ram clearance 0 to 5", stroke 5/8", table 5" x 5".

This useful, high quality No. 80 SPEEDY AIR PRESS is the last word in air power engineering—the result of 34 years of specialization in diaphragm compression. Extremely sturdy, it does dozens of jobs formerly handled by expensive presses—and does them more quickly, easily and economically. Operated by Speedy Foot Control, Hand, or Fingertip Valves. Order from your supplier or write direct.

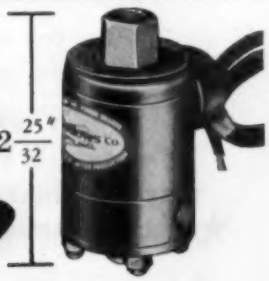
Write for New Catalog of Speedy Air Tools and Accessories

W. R. BROWN CORP., 2655 N. Normandy Ave., Chicago 35

AIR TOOLS • AIR VISES • AIR REGULATORS • FILTERS • COMPRESSORS

Circle 19 on Reader Service Card

NEW HIGH CAPACITY 3-WAY AIR-PILOT VALVE



Bellows "EPV" Sets New Performance Standards for Small Valves

FREE-FLOW CAPACITY OF 5.4 CFM AT 100 PSI

CHOICE OF 115, 230, 440, OR 12 V. SOLENOIDS

PORT SIZE ....1/8" ORIFICE .....1/16"	MAX. AIR PRESSURE 120 PSI	OPTIONAL PORT FOR MANIFOLD MOUNTING

The EPV's size and capacity make it highly versatile. It is equally rugged and dependable. Solenoid coils are "potted," providing almost 100% freedom from vibration damage. Coils are designed for continuous duty at speeds as high as 600 cycles per min. Moving parts which lie in the air stream are of stainless steel to resist corrosion.

Bulletin EPV-30 Gives Full Information

Address Dept. AH-655

1079A

The Bellows Co.

AKRON 9, OHIO

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Circle 7 on Reader Service Card

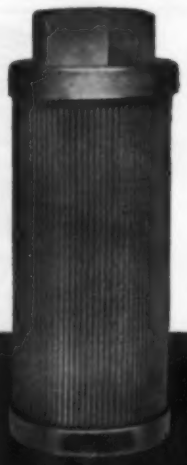
Hydraulic CYLINDERS to specification

AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

AMERICAN HOLLOW BORING COMPANY

1954 Raspberry St., Erie, Pa.



★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH

The New

CAPITAL HYDRAULIC OIL FILTER

WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL · EASY TO CLEAN · LONG LIFE · LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.

5837 South Ashland Avenue Chicago 36, Illinois

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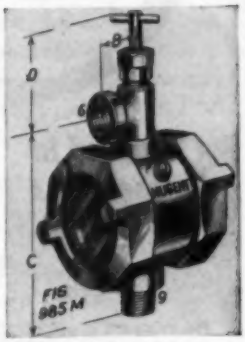

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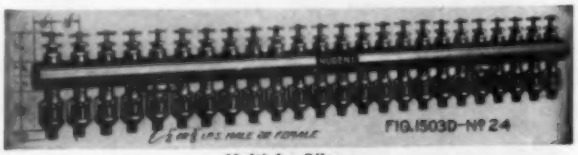

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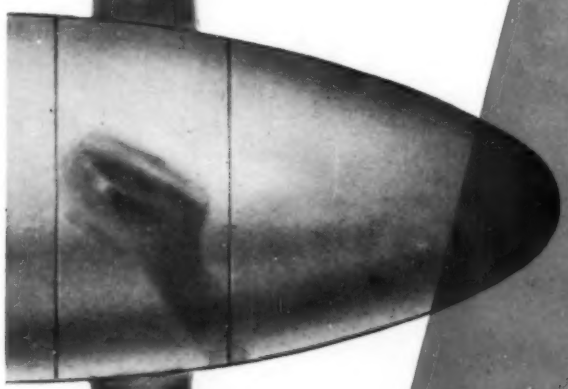
cartridge® pumps...

here's another reason why original equipment manufacturers should see Pesco before making their own pumps

Actual size illustration of Model 011815 Pesco Cartridge Pump showing inlet and outlet ports. Pump delivers over 2 gpm at 5050 RPM and 1050 psi. Low weight is a feature of the unique Cartridge Pumps—this unit weighs only one pound.



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